Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

JUNE, 1961

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48th in Boston

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Read and pass on—

PLATING POWER BY DC POWER SPECIALISTS



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Mathematical Design from Scripta Mathematica



Our new Brookfield plant exemplifies our continuing research and development program. Here, complete laboratory and test facilities help initiate new designs, and controls for greater rectifier economy and efficiency. Those savings are passed directly on to you—the user.

No matter if your power requirements are large or small, typical or different, required *yesterday* or in the near future, you can rely on RAPID because at RAPID power supplies are our SPECIALTY.

From the smallest bench model to the largest of the automatics, RAPID offers speed in delivery and the utmost in value.

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BLACKENING: Ebonol® Additive "S" — Eliminates red smut when blackening steel.

METAL STRIPPING: Enstrip® S-60 — Low cost, water soluble powder strips nickel rapidly at room temperatures.

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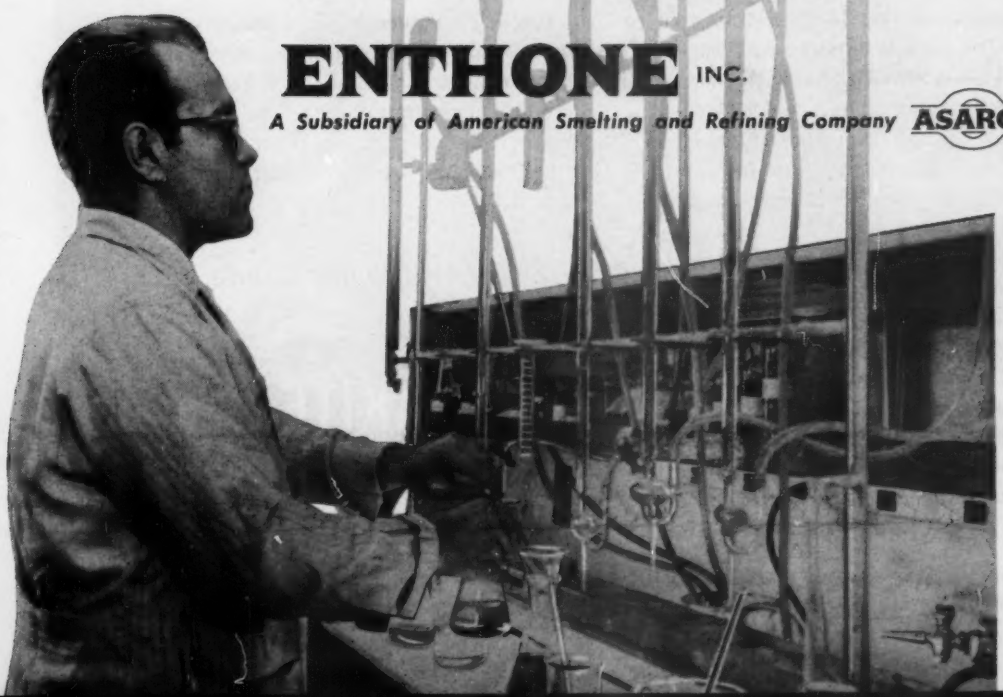
For your copy of brochure describing methods and materials to speed production, cut costs and produce better finished products, write to: Enthone, Inc., 442 Elm Street, New Haven 8, Conn.

*The scientific solution of metal finishing problems.

ENTHONE INC.

A Subsidiary of American Smelting and Refining Company ASARCO

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For top efficiency in tank cleaning

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OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



First choice in heavy-duty tank cleaning —hard-working Oakite "24"

Users everywhere agree that their best way to clean iron and steel parts is to tank-soak them in a hot solution of heavy-duty Oakite 24. This hard-working alkaline cleaner gets under the dirt layers and literally tears the soil from the surface. Despite excessive soil contamination of solution Oakite 24 maintains proper pH level and provides long, effective cleaning action.

Oakite 24 is but one of a wide range of alkaline tank-cleaning compounds. Others include medium and light duty oil and grease removers; self-emulsifying solvent cleaners specially designed for removing buffing compound residues, pigmented drawing compounds and other tenacious burned-on solid-particle dirts and smuts. Also available is a useful selection of materials for cleaning brass, copper, aluminum, magnesium, lead, tin and zinc.

Which is best for you? Only you and the Oakite man together can decide. It depends on your equipment, the parts you process, the next production step. Ask the Oakite man. From over 30 materials, you're *sure* to get the one cleaner that works most efficiently for you. Write for Bulletins. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

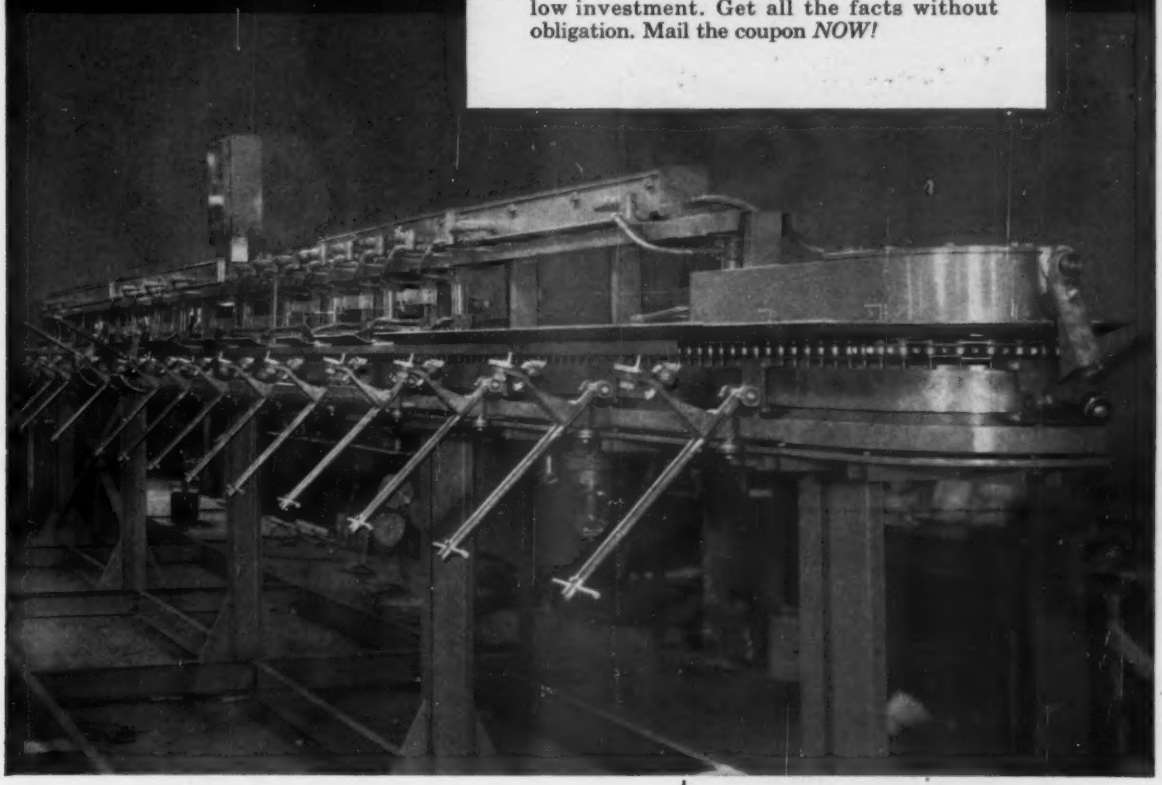
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MULTIPLE PROCESS PLATER

Up to 5 or more process cycles ...at the same time ...on one machine ...automatically!

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Let us have information on the fully automatic Select-O-Matic.

Name.....

Title.....



2 OPERATIONS SAVED.
On base of small waffle iron, 1 cut-down operation, and 1 hand coloring operation have been eliminated through the use of Superlume.

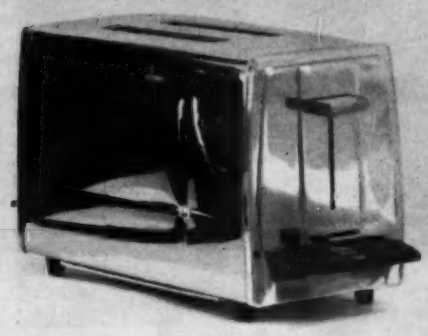
1 OPERATION SAVED.
On base of large waffle iron, 1 coloring operation is no longer necessary.

3 OPERATIONS SAVED.
On round toaster shell, 1 cut-down operation and 2 coloring operations have been eliminated.

1 OPERATION SAVED.
On the steam iron shoe, 1 hand coloring operation has been eliminated.

yet SUPERLUME vastly improves all 5 of these Son Chief products ...and at no extra cost.

says NICHOLAS J. LAZZARO, JR.
Asst. Plant Superintendent
in Charge of Finishing,
Son Chief Electrics, Inc.,
Winstead, Connecticut



HIGHER QUALITY FINISH.
On square toaster shell, same finishing operations are required with Superlume, but appearance of product is tremendously improved. On all 5 products, in fact, Superlume has stepped up product quality appreciably—and, in every instance, *at no increase in cost.*

Son Chief Electrics, Inc., appliance makers, sought a thicker, brighter plate, more rapidly applied. They found it in Superlume—along with major reductions in finishing operations, plus what Nick Lazzaro calls "Tremendous improvement in our products' appearance ... a real breakthrough in quality."

Actually, Son Chief is plating *twice* as thick in the same time as before (using 60 amps per sq. ft. instead of 30).

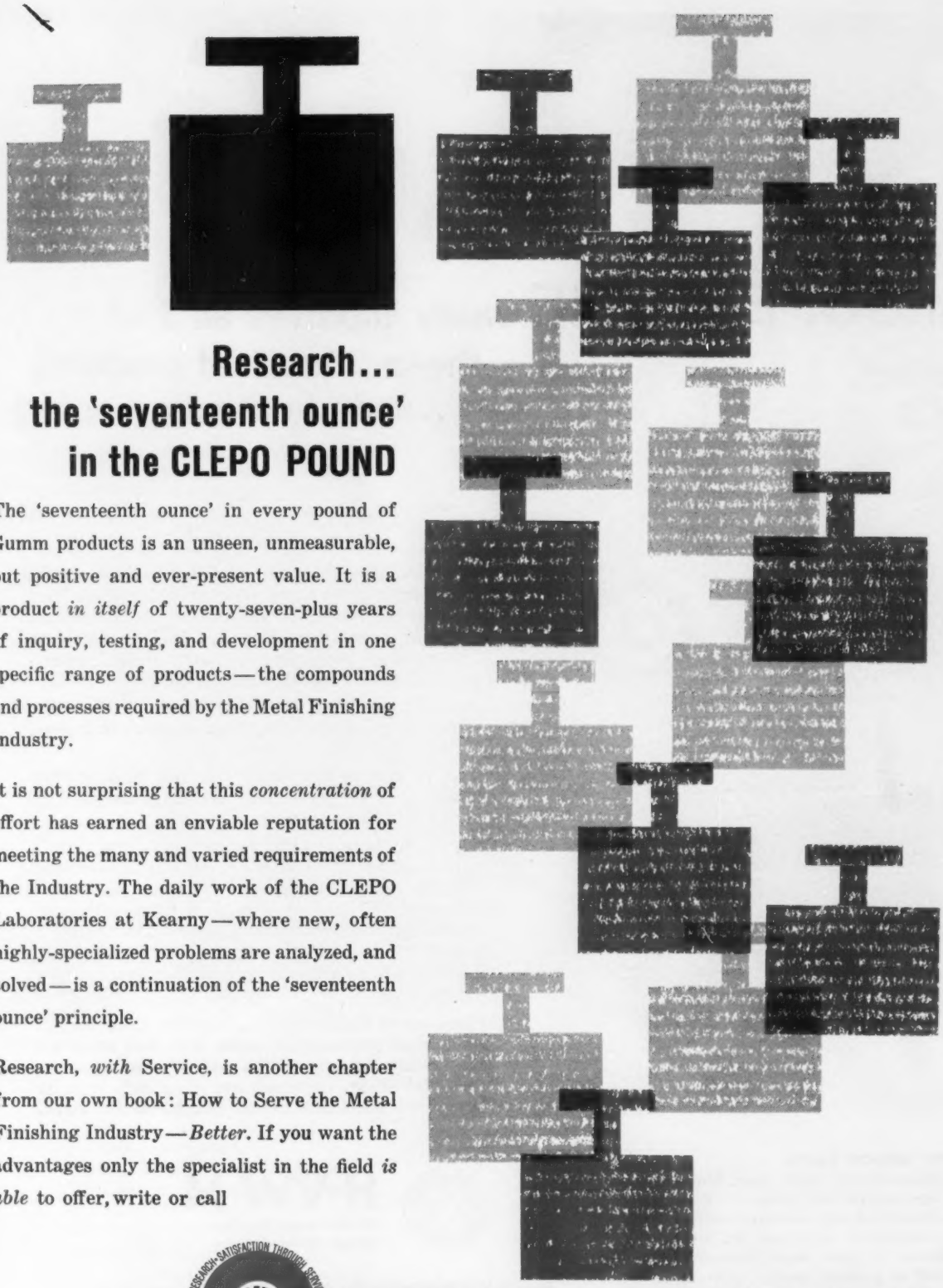
They're plating flat pieces now and forming *after* plating ... a big production advantage unique with highly ductile Superlume.

Superlume bath is easier to maintain. Son Chief's normal operating schedule is 5 days, 16 hours a day. But for two months every year, they work on a *24-hour/5-day basis.* Average pieces per hour through trouble-free Superlume: 336, with a low of 226, a high of 904. Son Chief plates 30 different parts ranging from 1 to 20 inches long. Superlume bath in use: 3100 gallons.

Good-sized operation ... healthy benefits ... no added production costs. For full facts on Superlume as applied to *your* operation, contact H-VW-M. Chances are you, too, will be better off with this better bright nickel bath.

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Progress in metalfinishing through advanced processes • equipment

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Moulds made entirely of Barrett Sulfamate Nickel. Photo courtesy Columbia Records, Inc.

making nickel talk

Sooner or later a good idea comes along in a business and makes a better product. It does the job well and in the long run saves the buyer money. It breaks through old concepts. It helps make successful operations out of the companies that buy the product and the company that makes the product. Sooner or later it happens in every business, just as it happened in the industry that makes record stampers. The idea was Barrett Sulfamate Nickel Plating. Not a decorative nickel (they're good and have their place) but an engineered, stress-free, ductile nickel that's purified and ready-to-operate. The process saves time. It's easy to maintain and control. Deposits pure nickel, free from stress, which often causes cracking, warping, peeling, and premature fatigue failure. It allows part forming after plating and protects against high temperatures. No wonder that the record stamping industry has used Barrett Sulfamate Nickel since Barrett first made it available. No wonder that when they talk nickel (or make nickel talk) they talk Barrett Sulfamate. They know that Barrett and sulfamate technology are synonymous.

Request Bulletin SN

Shelton, Connecticut

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chemical products company, inc.



OUT-of-DATE or UP-to-DATE

how does your chrome plating stack up?

You can keep your chrome-plating process in step with today — with Diamond CPA 1800®.

This modern teammate for Diamond Chromic Acid increases plating speed and covering power. Allows a broader operating range. Simplifies anoding and produces a brighter, harder coating. Improves the metallurgical characteristics of chromium plate.

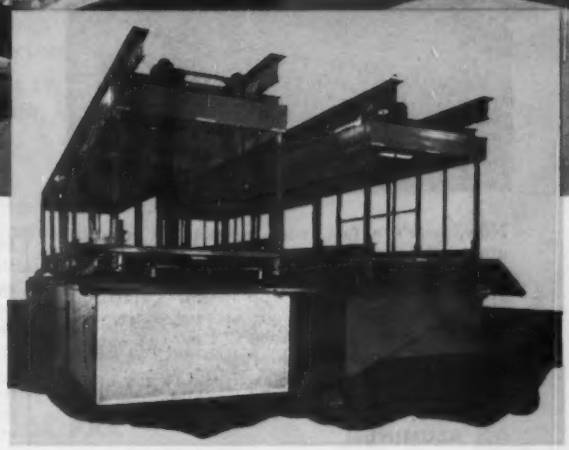
In short: Diamond CPA 1800 cuts your unit costs and saves you money. Diamond developed it. Your Diamond CPA 1800 Distributor can supply it where and when you need it.

For further information — call or write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals



SECRETARY'S DELIGHT, SMITH-CORONA MARCHANT 400



MODERN CROWN "MP"

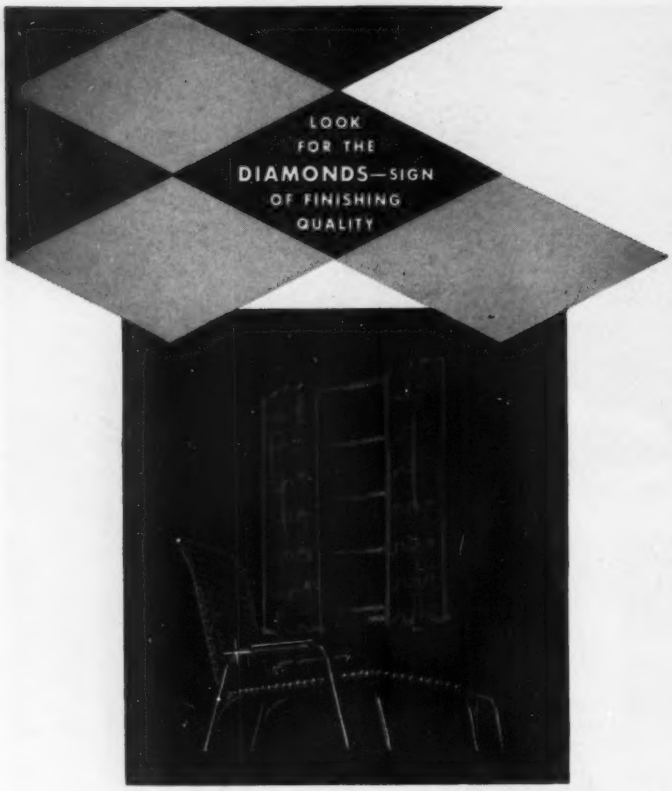
aids production at Smith-Corona Marchant

Many companies like Smith-Corona Marchant are daily maintaining quality plating and meeting production schedules with CROWN M.P. (multi-purpose) custom designed mechanized plating machines. At Smith-Corona Marchant one CROWN M.P. Automatic does the zinc plating while another CROWN M.P. handles the nickel and chrome plating of thousands of precision typewriter parts every day.

Mechanizing and automatic programming of your plating department can easily be the key to stimulating profits by—reducing costs—increasing production—and improving quality—for processing of barrel or rack type work—write for Bulletin M.P.

CROWN

CROWN RHEOSTAT and SUPPLY COMPANY



NOW—A Great New Combination for DOUBLE PROTECTION Against Corrosive Conditions on Aluminum, Magnesium or Zinc

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CHROMATE CONVERSION COATINGS
and
IRILAC™
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Now, here's a fast, easy, economical way to almost double the protection against corrosion on your product. Simply follow up the IRIDITE process with a fast, easy application of IRILAC . . . and you've given your product extra protection for longer resistance to corrosive conditions, longer shelf or storage life protection from handling, and increased beauty for more attractive appearance and faster sales.

ON ALUMINUM

An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

ON MAGNESIUM

IRILAC over an IRIDITE No. 15 finish increases corrosion protection, and provides resistance to finger printing and abrasion on all types of products, with color appearance ranging from light to dark brown.

ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

IRILAC is the tradename for a line of clear protective coatings for all metals. As safe and easy to handle as water, they may be applied by brush, dip or spray methods. No exhaust or special fire protection equipment required. Adds protection and abrasion resistance to any base metal, plated part or parts treated with electrolytic or chemical post treatments, without chemical change.

For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for FREE TECHNICAL MANUAL. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.



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Chemical and Electro chemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

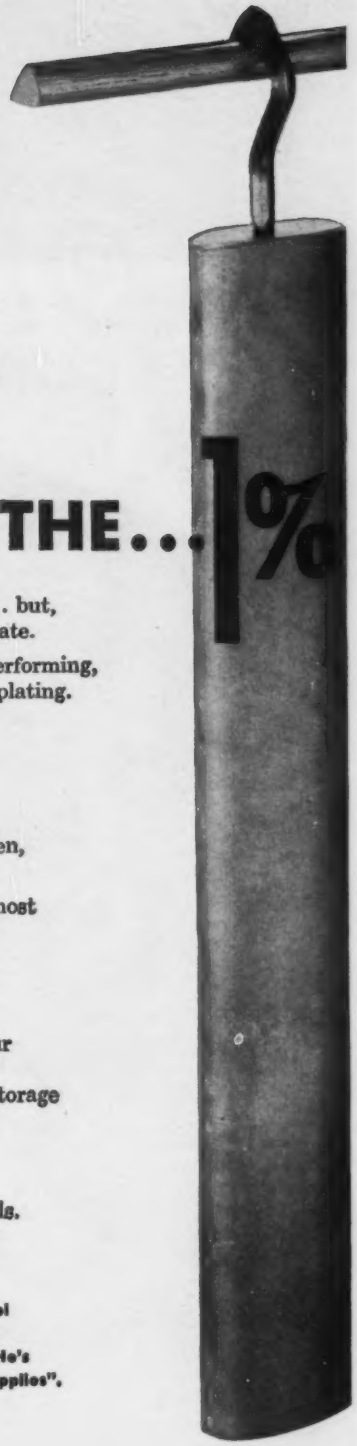
IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY

BUYING 99+% NICKEL?

Here's why you should

CHECK WHAT'S IN THE...1%



Of course, you, as a nickel user, want 99% pure nickel anodes . . . but, it's that 1% that makes the difference between good and bad plate.

At Allied Research, we make sure that 1% gives you a better performing, more economical anode, for fast, smooth, low-cost and efficient plating.

Here's how:

1. All our nickel anodes are cast from 100% electrolytic nickel—free from harmful contaminates.
2. Carbon and silicon are carefully added to assure you of even, constant corrosion rate and faster, smoother plating.
3. Copper and iron are kept to a minimum—well below the most rigid specifications—eliminating excessive brightener consumption, down time or rejects.

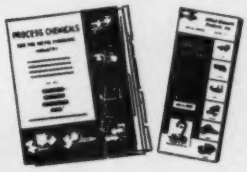
NEW ALLIED RESEARCH ANODE PAK



Sturdy, corrugated cartons keep your anodes clean, uncontaminated—ready to use. Paks make handling, storage and inventory easier, too.

NICKEL RECASTING SERVICE

Your nickel butts and spears recast under the same rigid controls. For really substantial savings, get details on our Nickel Recast Blanket Purchase Plan.



For full information on Allied Research Nickel Anodes, Anode Pak or our Nickel Recasting Service, contact your Allied Field Engineer. He's listed in the yellow pages under "Plating Supplies". Or, write for FREE TECHNICAL DATA FILES.

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Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

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Harshaw has faithfully served the plating industry for more than 60 years

Write for our literature on Harshaw's processes, anodes, and chemicals.

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★ *CHEMICALS*
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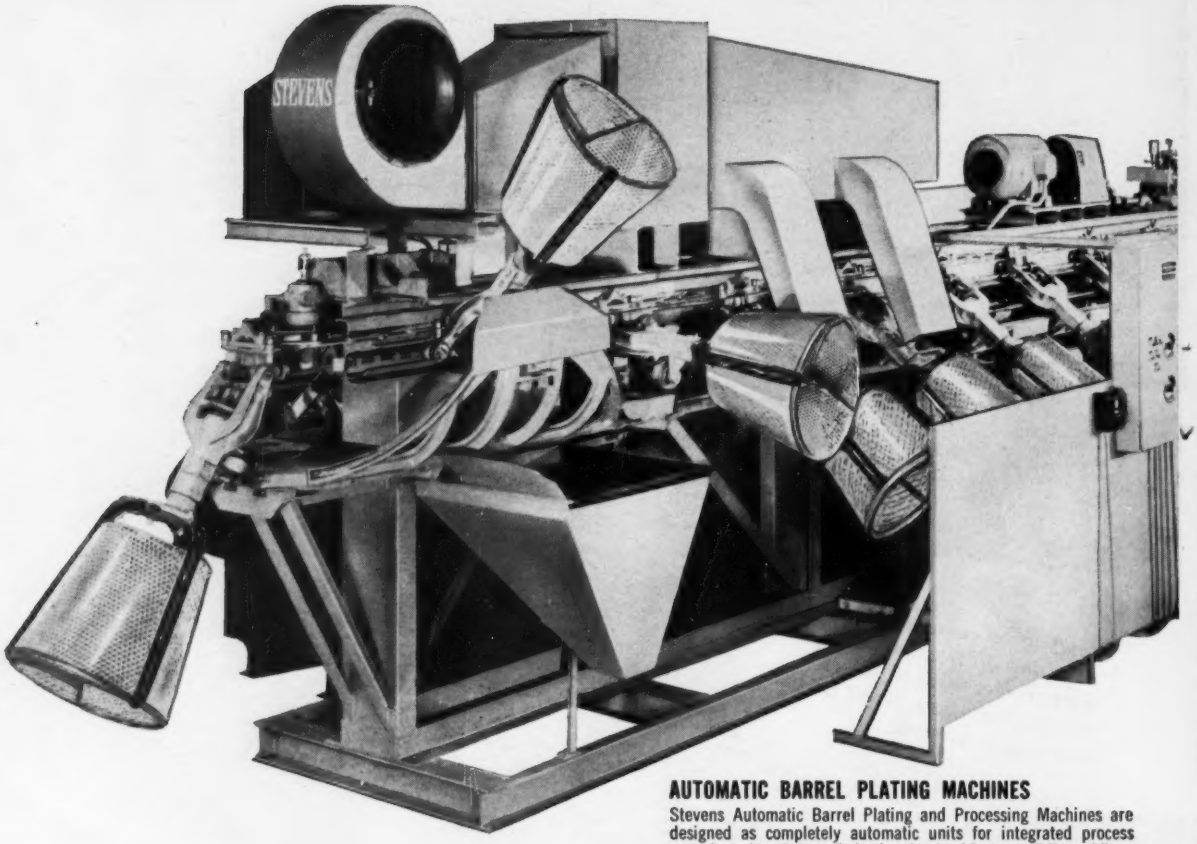
and other countries. Standardizing on Harshaw processes makes these same high quality processes available to your foreign facilities.

Harshaw processes give the Plater *what he wants* — the leveling, the corrosion resistance, the beauty . . . the simple operation, the economy. The millions of gallons now in operation testify to this. As your changing requirements demand new and better plating materials, look to the leader! Harshaw research will find them. Harshaw know-how will make them. Harshaw service will deliver them to you.

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Plating Processes also available through the following Foreign Distributors or Manufacturers:

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AUTOMATIC BARREL PLATING MACHINES
Stevens Automatic Barrel Plating and Processing Machines are designed as completely automatic units for integrated process manufacturing. Automatic load and unload features, lidless oblique barrels and optional built-in dryers provide the most economical and rapid means of plating small and medium-size parts.

STEVENS...TIME-TESTED SOURCE

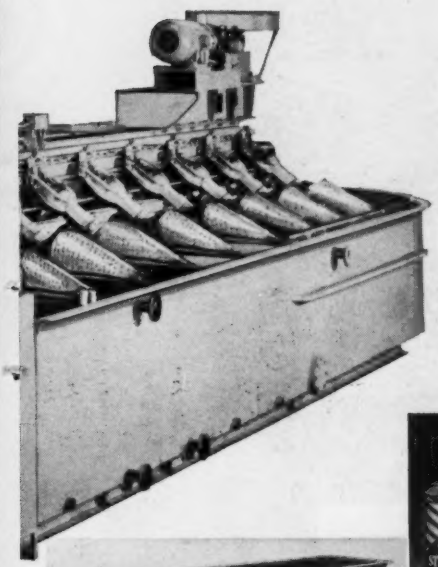
For more than fifty years, Frederic B. Stevens, Inc., has been a leader in the development and sale of prefinishing and plating equipment and supplies. If you have parts to buff, polish, clean and plate, this experience is yours for the asking. Naturally, the equipment to do this work incorporates the latest techniques for high production and lower costs.

This catalog in miniature is an example of our wide range of equipment and supplies. In addition to the famous Stevens Model C Barrel Machine shown above, we also design and build Automatic Rack Plating Machines to meet every requirement.

Pick out what you need—then get in touch with your local Stevens representative. He'll tell you what you want to know.



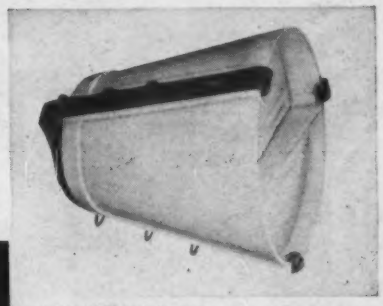
LITTLE STEVE PLATING AND PROCESSING MACHINES
The Little Steve Barrel Machine, Little Steve Vertical Lift Rack Machine and The Little Steve Rack Machine with hump cam action put a lot of plating and processing potential in the smallest amount of space. They fit into any existing factory layout, are economical to install and maintain and offer extreme simplicity of operation.





SILICON RECTIFIERS

The new Stevens line of silicon rectifiers represents a major advance in design, construction and performance. All new from top to bottom, they feature self-contained controls, hinged inspection doors, new, one-piece finned heat sink with non-aging silicon cells, built-in ventilation system, positive protection from overheating, overloading and short-circuiting.



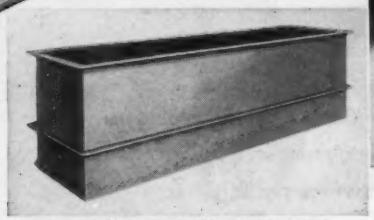
STEVALITE BARRELS

Lighter, stronger, longer-lasting polypropylene Stevalite oblique barrels tumble parts more effectively, give improved plate distribution. Designed for use on all Stevens Automatic Barrel Plating and Processing machines, they require no lids. Also available in Plastisol-covered steel.



BUFFING-POLISHING COMPOSITIONS

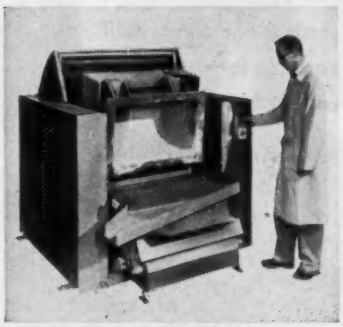
Stevens liquid and bar compositions are preferred by metal finishers for all buffing, polishing and coloring operations. Whether you require a heavy cut or extremely high color, there's a job-matched Stevens formula for the job.



STILL TANKS AND TANK LININGS

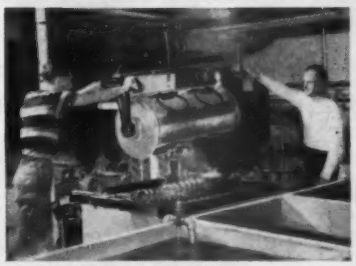
Stevens builds still tanks of steel, aluminum and stainless as well as special purpose tanks to meet specific needs. Complete Koroseal, neoprene and rubber tank lining facilities in three convenient locations.

FOR FINISHING and PLATING NEEDS



ROTO-FINISH VIBRATRON

Revolutionary method for fast mechanical finishing. Entire abrasive mass is agitated so that media are used more efficiently. Offer minimum wear, field-proven performance. See your Stevens representative for complete details.



HORIZONTAL BARRELS

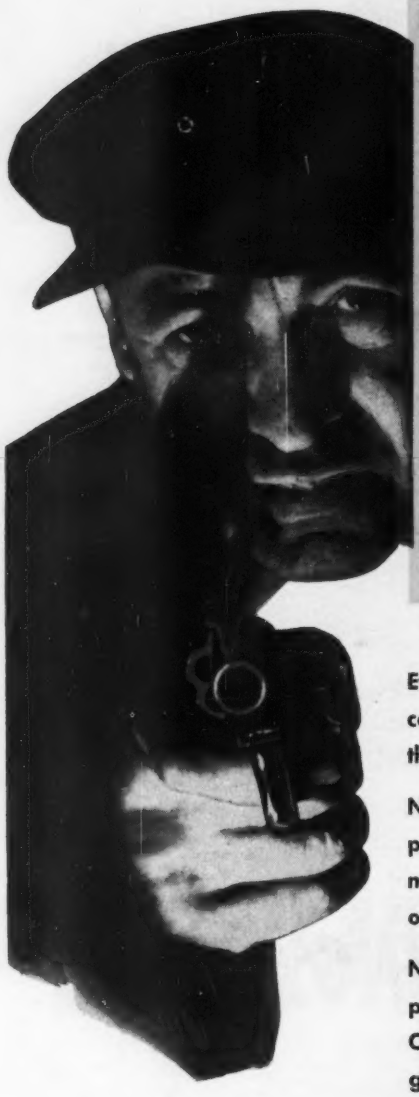
Where horizontal barrel plating lines are recommended, Stevens will engineer them to meet your specific requirements. Cylinders can be furnished in Tempron or Plexiglas.

Stevens manufactures a wide variety of processes, supplies, chemicals, anodes, filters and buffs for all plating and finishing operations. Prompt delivery is assured from many warehousing points throughout the country. Call your Stevens representative today.

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are you being ROBBED by finishing REJECTS?

Even the most expensive materials and the finest finishing processes can produce costly rejects if "bargain" compounds have failed to do their job. A finish can be no better than its surface preparation.

Northwest's Cleaning Specialists offer a complete line of top quality products for every "surface readying" requirement, on every type of material. These products have *proved* their dependability over years of rugged production use in the country's finest finishing operations.

Northwest's continuing research and development program keeps our products well ahead of industry's constantly changing requirements. Our fine staff of thoroughly experienced Cleaning Specialists will gladly help you work out the best surface preparation for your product and "stand by" to help you keep it functioning at top efficiency.

Why not save time and rejects by using Northwest's dependable products and services.

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M & T

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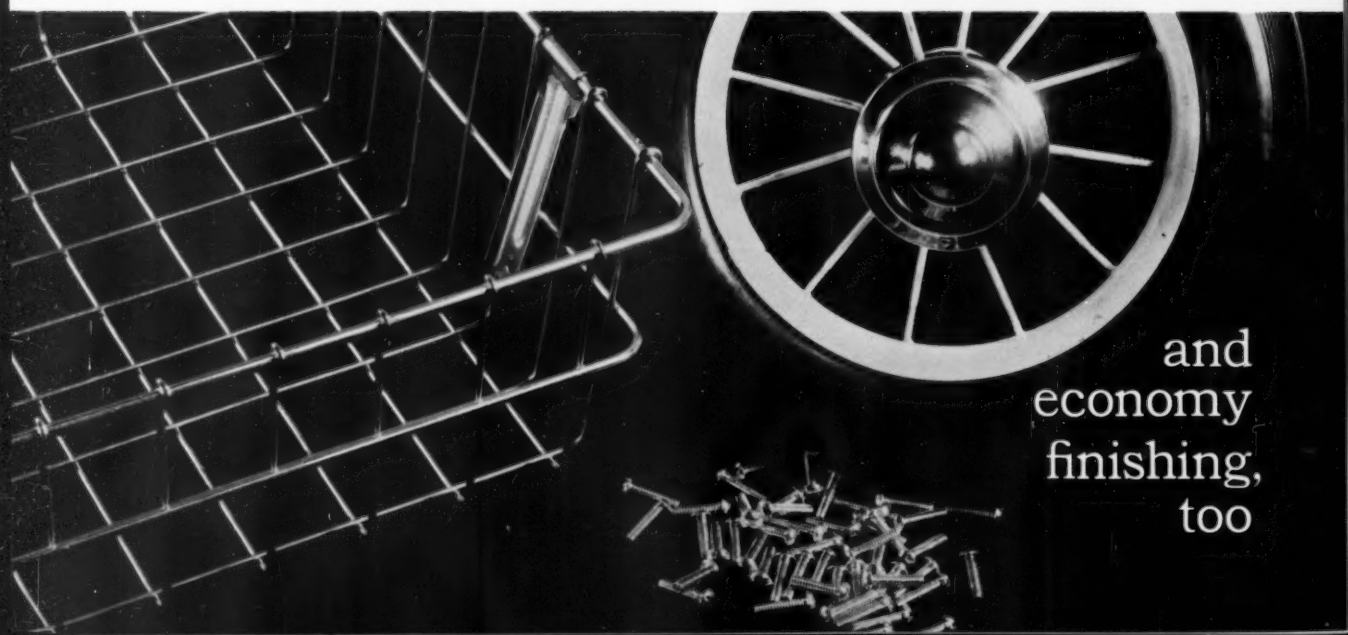
Zn Sn
Cu Ni Cr

an open invitation to metal finishers going to the AES Convention in Boston June 18-22... make a point of visiting our suite in the Hotel Statler Hilton...ask about our newly expanded services... enjoy M&T traditional hospitality. *we'll be looking for you.*

METAL & THERMIT CORPORATION • General Offices: Rahway, N.J.

Single responsibility for bright quality finishing...





and
economy
finishing,
too

CHROMIUM PLATING to fit every need

Unichrome SRHS® Chromium: Your every decorative and industrial "hard" chromium plating requirement can be met efficiently and economically with specially formulated Unichrome SRHS Compounds. Modern SRHS processes automate the bath with self-regulation of important ingredients, thereby maintaining optimum plating balance. SRHS solutions plate up to 80% faster than ordinary chromium, increasing productivity of equipment. Wider bright plate range and superior covering power reduce rejects.

Fume-Controlled SRHS Compounds, available for decorative plating, automatically suppress chromic acid fumes. Chromium plating solutions made up and maintained with these Fume-Controlled SRHS Compounds can increase worker efficiency, reduce your plant maintenance costs.

M&T MICRO-CRACK SRHS Chromium: Dramatic improvement in corrosion resistance of decorative brightwork is obtained with these unique SRHS processes. They provide a single or duplex deposit of at least 50 millionths of an inch thickness which has an extremely fine crack pattern, unlike the gross cracks in ordinary chromium this thick. Reducing corrosion cell potential at surface defects, this structure inhibits unsightly pitting and basis metal corrosion, prolongs outdoor life of brightwork.

M&T Duplex Chromium, the preferred type of Micro-Crack Chromium for most purposes, is a two-layer deposit. First, a layer over the nickel from an SRHS CF-520 solution to assure ample coverage and corrosion resistance in recesses; then a special SRHS deposit from a CR-110 solution to produce the highly effective Micro-Crack finish.

Unichrome® CRACK-FREE SRHS Chromium: Free from corrosion-inviting cracks, Crack-Free SRHS deposits improve protection. The solutions have superior covering and throwing power – deliver more uniform plate distribution and greater protection for recesses. Two types of deposit are available: *bright*, for improved throwing power in decorative work; and *matte*, for industrial applications where best resistance to corrosion, impact, thermal shock, and wear is required.

BRIGHT NICKEL in the news

M&T Bright Nickel 30-W Process: Here is a new Watts-type bath unexcelled in operation and economy – an achievement of M&T's electroplating research laboratories. It has been thoroughly field proved and is already in service in a number of substantial installations.

The M&T 30-W solution uses three efficient and easily controlled organic addition agents for brightening and protecting the deposit against pitting. Advantages include:

- Ductile deposits with outstanding receptivity for chromium.
- Slow depletion of the addition agents for economy.
- Wide bright plate range for highest plating speeds.
- Easy control and maintenance, stability over wide pH range.

Incobar* Nickel Anodes: M&T is a prime distributor for anodes of Incobar* rolled nickel. No finer quality exists, as experienced platers know. Of high purity and uniformity, these carbon-type rolled anodes are available from conveniently located M&T warehouses.

Nickel Salts and Supplies: Available as a complete "package" for nickel plating: M&T Brighteners and Addition Agents; Nickel Sulfate and Nickel Chloride for bath make-up and replenishment; Boric Acid. All chemicals are of highest quality to keep trouble out of your nickel plating bath.

**Reg. Trademark of The International Nickel Company, Inc.*

COPPER PLATING to match requirements

M&T Bright and Semi-Bright Cyanide Coppers: These advanced processes permit use of high current densities for fast plating without burned edges. Stability of addition agents gives greater freedom from decomposition difficulties . . . assures economy, easy control.

Unichrome Pyrophosphate Copper: This is one of the densest copper deposits available. The plate is uniform, extremely smooth and ductile and can be plated bright. Containing no cyanide, the bath minimizes expenditures for waste disposal. Being nearly neutral in pH and operating at 110°F to 140°F, it is first choice for plating printed circuits and computers, for electroforming, for undercoating nickel.

M&T Bronze: Resembling 24K gold in color, M&T Bronze makes an attractive final finish as well as a superior undercoat for coverage and corrosion resistance. It plates fast with exceptional throwing power, depositing about 88% copper and 12% tin in various degrees of brightness.

M&T Neochel®: Compatible with all cyanide copper and bronze baths, this addition agent increases cathode and anode efficiency, cuts cyanide consumption, improves anode corrosion. It thereby helps to produce smooth deposits, and minimizes effect of contaminants.

The copper package available from M&T *also includes anodes of exceptional purity, cast or rolled in all popular shapes and sizes, plus OFHC copper anodes.*

ZINC FINISHING for brightness and durability

M&T Bright Zinc Processes: These are alkaline processes with special brighteners that result in outstanding barrel or rack operations and quality deposits. The plate has exceptional crystal-clear luster, and excellent ductility. And there's minimum brown stain in storage.

M&T Zinc Brighteners: Zinc Brightener 25, a liquid, and solid Zinc Brightener 19 work equally well in barrel, still tank or automatic plating, and give economical "mileage." A stable and concentrated liquid, Brightener 25 is ready for immediate pouring. It assures coverage and a uniformly bright plate even in low current density recesses.

Unichrome Chromate Dips: M&T offers one of the widest lines of compounds for chromate treatment of zinc. This choice permits proper matching of the finish to your requirements in corrosion resistance, color and economy. Finishes include clears, yellow, olive, black, and popular, attractive, dyed colors. All provide a good base for organic coatings.

Unichrome Clear Enamels: A Unichrome baking or air-dry coating on top of a Unichrome Dip Finish provides a product finish of superior quality. Generally, the combination not only costs less than other types of finishes, but also stands up better under humid conditions.

The M&T *zinc plating package also includes any standard size or shape of zinc anodes, and the various salts for bath make-up and replenishment.*

TIN & TIN ALLOY
plating processes

M&T High Speed Tin Plating: This process uses Potassium Stannate for a bath that is so stable and operates at such high current densities that it cuts both control problems and operating costs. Production goes up as a result of the higher plating speed. Bath upkeep costs drop because of minimum sludging. Power requirements are reduced by the high solution conductivity.

M&T Sodium Stannate Process: Using the long time standard solution, this process offers easy control, wide operating range, excellent throwing power.

M&T Tin-Nickel: Plates directly on basis metal with outstanding covering power. Approximately 65% tin, 35% nickel, the alloy is highly resistant to tarnish and corrosion.

M&T Tin-Zinc: Deposits are usually 78% tin, 22% nickel with other ratios also obtainable. This alloy plate improves corrosion resistance and retention of solderability for electrical products.

M&T Bronze: See description on page 3.

The complete line for tinning also includes **M&T** *"High Speed" (pat.) anodes, pure tin anodes, and a variety of materials for immersion tinning.*



SPECIAL EQUIPMENT

High quality chromium plating of large volumes of small parts can be done easily and profitably with a *Unichrome Chromium Plating Barrel.* Two types available: one for continuous plating and one for batch production.

Tantalum equipment introduced by M&T for plating use includes heating and cooling coils that outlast lead coils many times over in acid baths; and heat exchangers with tantalum tubes.

COATINGS and INSULATIONS

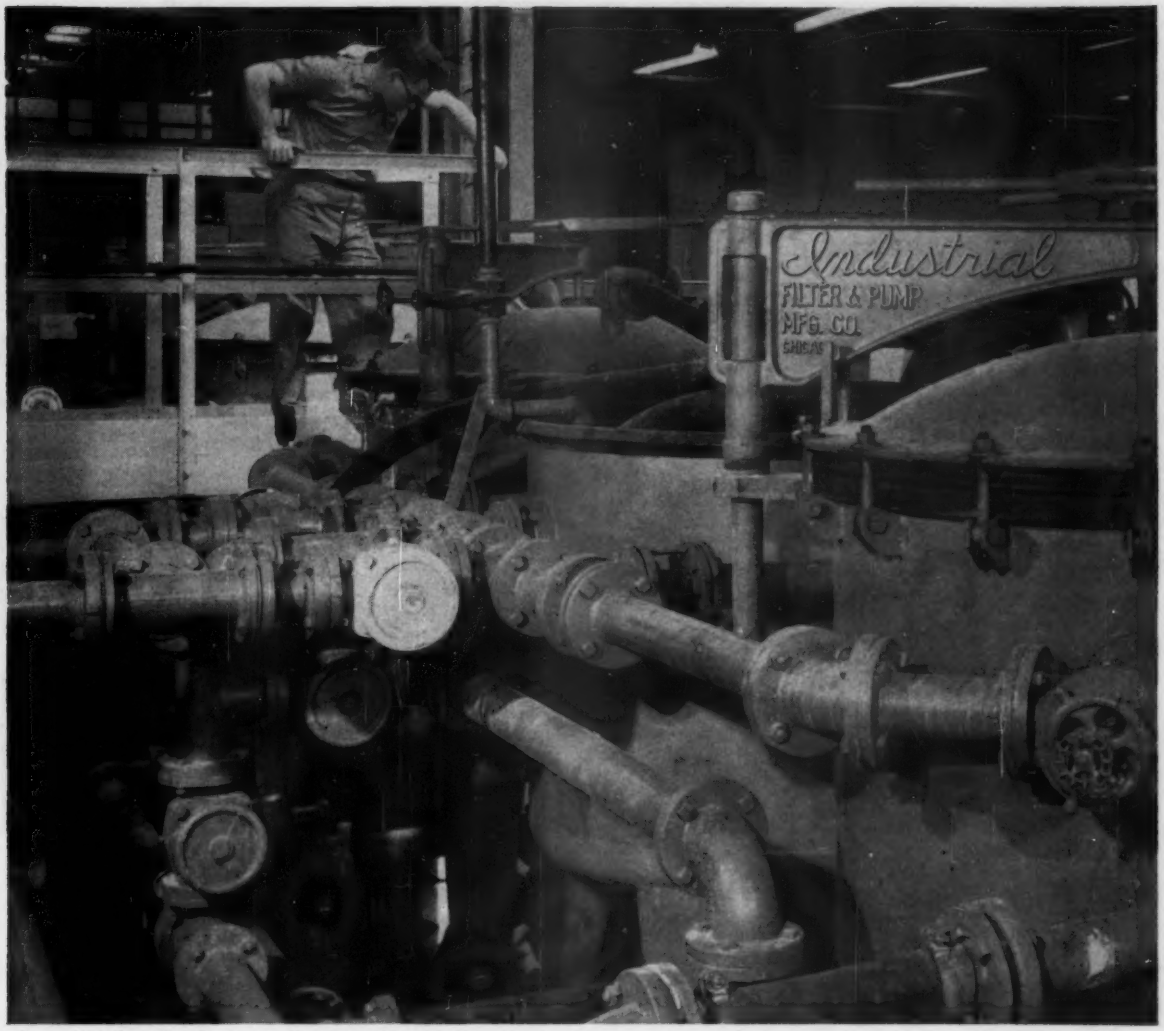
Unichrome Coating 218X assures you the finest quality plastisol rack coating for longest service life. It survives toughest plating and cleaning cycles, does not affect sensitive solutions.

Unichrome "Super 5300" Plastisol sprays a seamless tank lining that costs less to apply than a sheet lining, does a better job because it has no joints. It offers "lifetime" protection to tank exteriors.

Detailed literature and technical information is available on all products highlighted here. Remember that technical service accompanies all M&T processes and products. It is given willingly. It is plating-minded. It is supported by long experience in the field.

plating products
METAL & THERMIT CORPORATION

General Offices: Rahway, N. J. • *Atlanta, Ga. • Detroit, Mich. • E. Chicago, Ind. • El Segundo, Calif. • In Canada: M&T Products of Canada Ltd., Rexdale, Ont.*



Eaton Manufacturing Company, Cleveland, Ohio

"SARAN LINED PIPE

installs 3 times faster than other pipe we've used!"

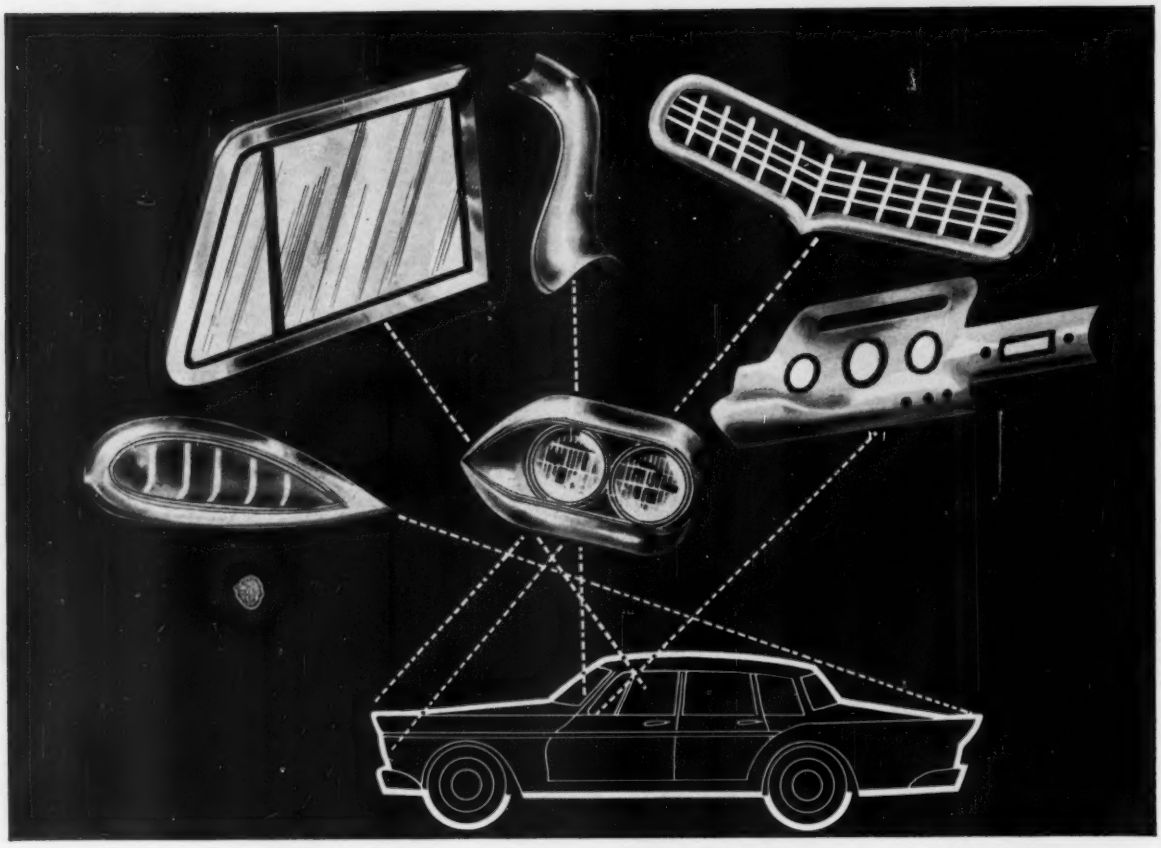
The Saran Lined Pipe above has carried more than 40,000,000 gallons of acid plating solutions at temperatures up to 160° F. In its 18 months of use, there's *not been a single failure* in the 1100 feet of Saran Lined Pipe at Eaton Manufacturing Company's Cleveland plant.

"In changing piping systems, our own maintenance men can put in Saran Lined Pipe with *no downtime* on our plating machines," says Mr. Harry Simpson, Maintenance Superintendent. "In fact, Saran Lined Pipe is so easy to cut and fit that we can't begin to estimate the total savings it's given us in time and labor, compared to other kinds of piping. We don't spend time waiting for a supplier to specially cut and rubber-line the pipe to fit our lines. We can put in Saran Lined Pipe three times faster than other piping—and indications are it will last substantially longer.

"In our experience, Saran Lined Pipe stands up extremely well under the hot muriatic and sulphuric acids we use and it has the strength and over-all economy we want."

For chemical processing plants, plating operations, and anywhere corrosive or reactive chemicals must be transferred, Saran Lined Pipe will give you one of the best and most durable piping systems obtainable. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can be cut, fitted and modified easily in the field with a minimum of special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 1568CF6.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan



Aluminum adds the bright touch

"Bright dip" aluminum parts and trim bring a high note of glamour to the graceful lines of modern automobiles. Practical, easily-formed aluminum appears as mirror-bright radiator grilles, body trim, window molding, light bezels, and a growing list of other parts.

"Bright dipping" is a chemical polishing process that dissolves the microscopic high points of a metal's surface faster than its low points. Thus, a few minutes' dip in the solution smoothes and thereby polishes aluminum parts to a high lustre. Then they are anodized for protection against wear and corrosion. This unique polishing process—also used with copper, brass and stainless steel—is becoming part of the manufacture of a long list of products extending from automobiles to zippers.

The major ingredient in "bright dip" solutions is phosphoric acid, one of the many phosphorus chemicals produced by Virginia-Carolina Chemical Corporation. V-C Phosphoric Acid, made from elemental phosphorus from V-C's own phosphate mines, is known for outstanding quality and purity. All three grades exceed American Chemical Society, National Formulary, and Food and Drug Regulations requirements where applicable.

V-C Phosphoric Acid	85% N.F. Grade	80% Food Grade	75% Food Grade
Sp. Gr. (20°/4°C)	1.691	1.635	1.581
Lbs./gal.	14.1	13.6	13.2
P_2O_5	61.71%	58.08%	54.50%
H_3PO_4	85.21%	80.20%	75.26%
Cl	0.0001%	0.0001%	0.0001%
Fe	0.0002%	0.0002%	0.0002%
Pb	0%	0%	0%
As_2O_3	0%	0%	0%

FREE BOOKLET "Bright Dip Hints" and samples available. V-C specialists, drawing on years of "bright dip" experience, are happy to give you detailed information in terms of your own operation. Write today!

Virginia-Carolina Chemical Corporation • Chemicals Division
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SUBLL-5	50 gph	150 gph	$195.00
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*Certified Field Results (samples on request)			

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- completely corrosion resistant
- trouble-free operation; one-year guarantee

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For filtering every solution:
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ALL METAL CONTACT ELIMINATION: Acid gold, rhodium, etc.
SKIMMER: Removes surface dirt.

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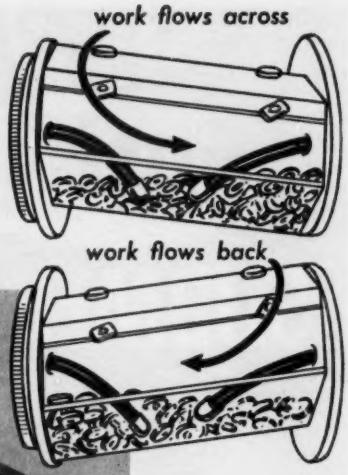
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MANUFACTURING CORP.

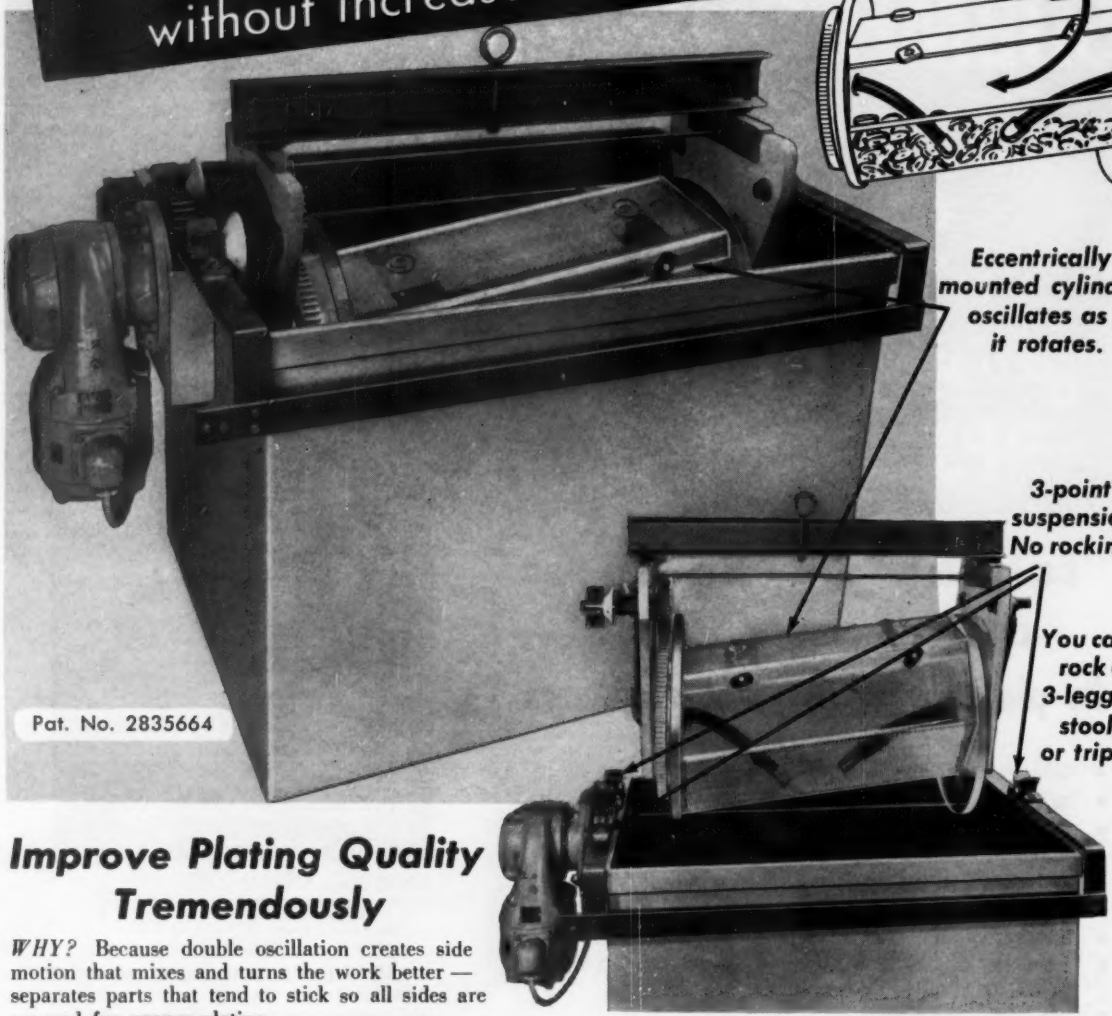
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A specified thickness is obtained quicker with no over-plating or underplating.

WHY? Because the work moves back and forth across the cylinder. None remains shielded by the cylinder ends as happens with conventional barrels. Consequently all work is equally exposed and receives equal deposit. It is not necessary to over-plate some of the work in order to adequately plate the rest.

You can replace present cylinders with BELKE Double Oscillating Cylinders.

BELKE Double Oscillating Cylinders are made in all sizes from 14x36 regulars to 6x12 portables.

They are available as replacements for present cylinders or as complete plating units.

They can be furnished with BELKE non-rocking 3-point suspension as illustrated or with conventional 4-point suspension.

Double oscillation soon pays for new cylinders by saving in time and materials. Order a BELKE Double Oscillating Cylinder and see the big difference.

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on rough, dull, unbuffed surfaces

Levelmax — the bright nickel process — reduces or eliminates surface buffing and polishing, simplifies chrome plating, makes possible bright plating of hard-to-buff areas. You get bright, smooth nickel coatings on poorly polished steel, unbuffed stampings and castings and dull copper plate. Levelmax is simple to control, has high tolerance to organic and metallic contamination, can be used under standard plating conditions. Levelling action is excellent. Levelmax bright nickel takes chrome easily. The Levelmax process is the most versatile of the nickel processes for varied product shapes, base metals and applications.

For complete working details, write on your company letterhead for Bulletin 191, Levelmax operating manual. Write Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y., or call your nearest Federated sales office.

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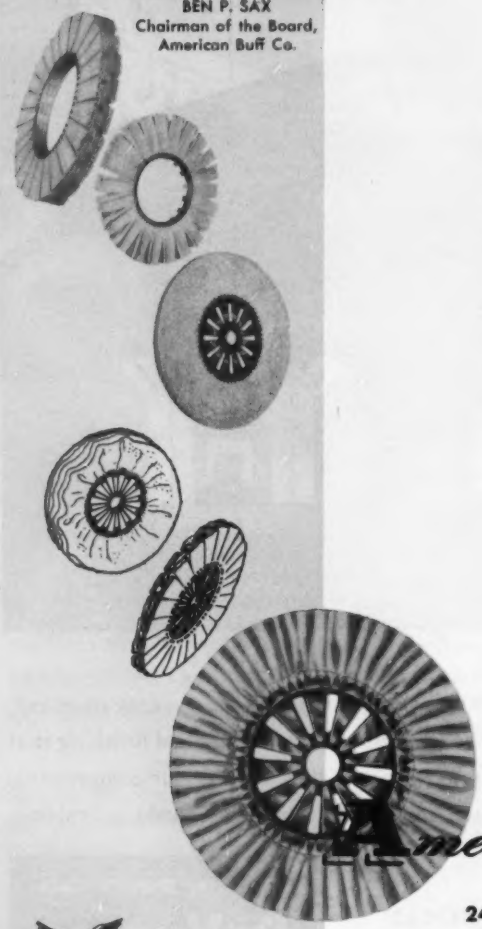
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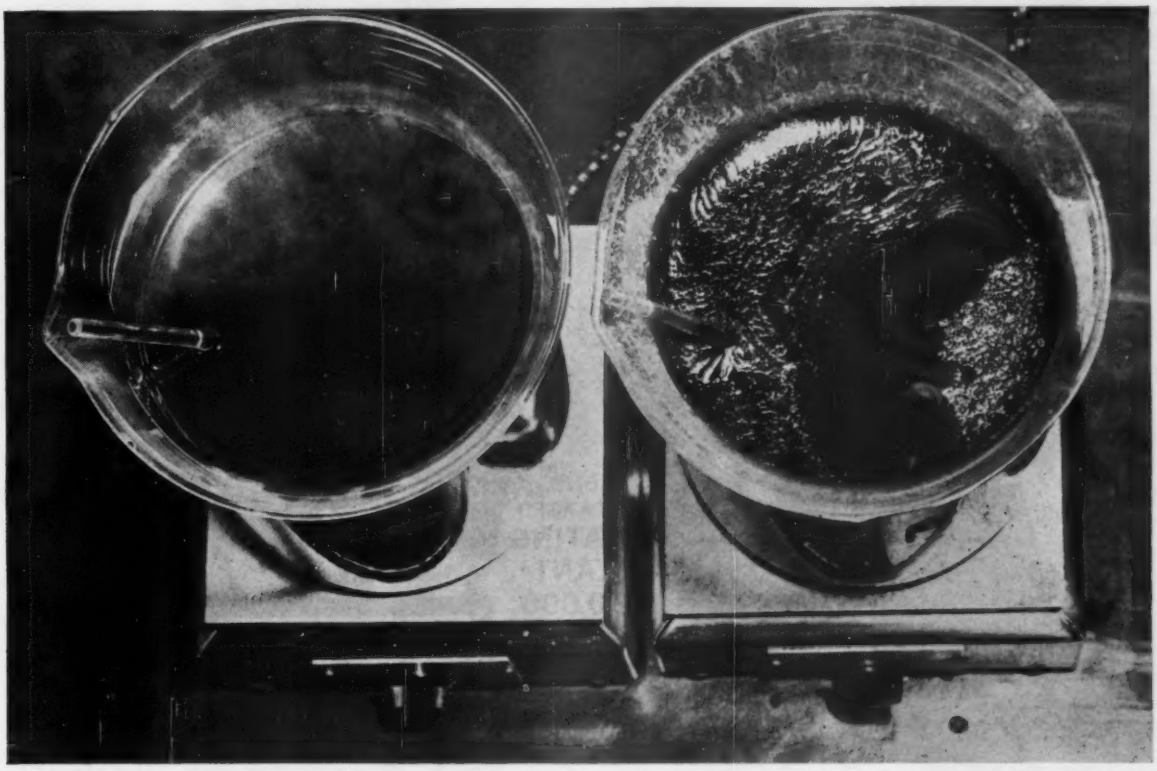
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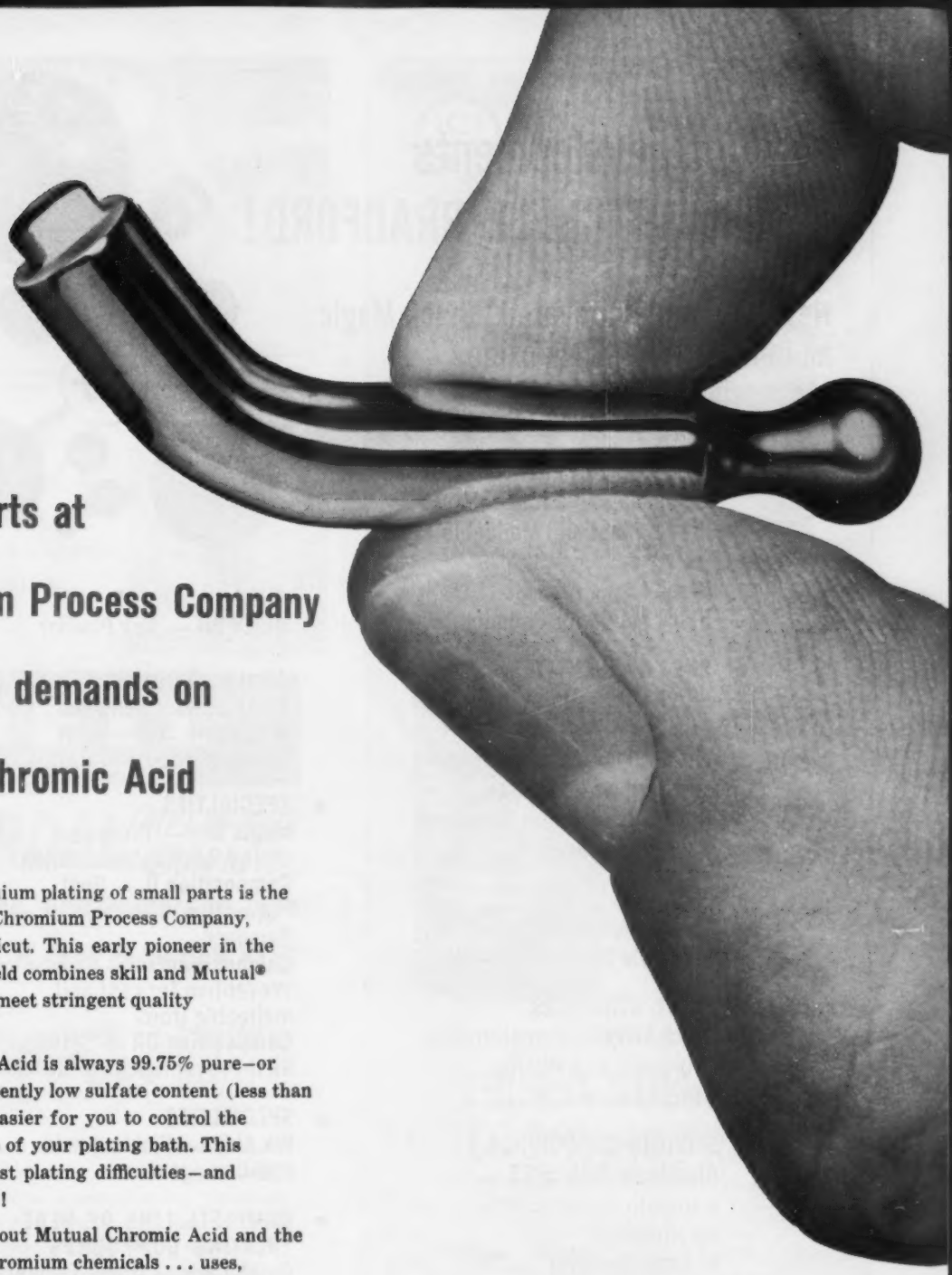
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Mutual Chromic Acid is always 99.75% pure—or better. Its consistently low sulfate content (less than 0.1%) makes it easier for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

To learn more about Mutual Chromic Acid and the Mutual line of chromium chemicals . . . uses, properties and comprehensive technical data . . . write for your free copy of Solvay's 80-page Technical Bulletin, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions. State whether you would like to have a representative call.

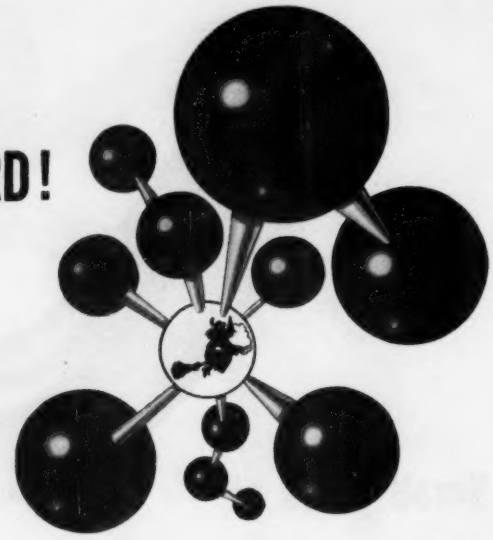
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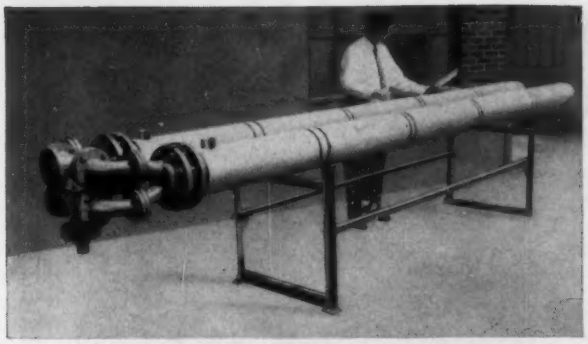
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  Black Magic for Cadmium
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  Rust-Pels — Water Repellent Rust Preventives
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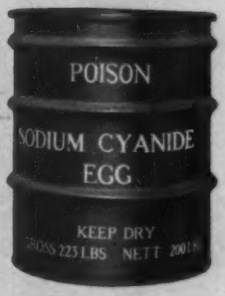
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WHAT'S NEWS IN ENJAY TECHNICAL SERVICE



Fine vinyl finish at 10-18% less cost

Here is another example of Enjay customer service. Enjay has solved an important surface coating solvent problem by experimenting with various blends of methyl ethyl ketone with methyl isobutyl ketone for vinyl surface coatings. With a 50/50 blend of these Enjay solvents—users can obtain excellent surface hardness, gloss, and finish at a saving in cost per pound of solids dissolved, relative to 100% MIBK, of 10-18%. This is one more example of how Enjay is helping its customers turn out quality products at a saving.

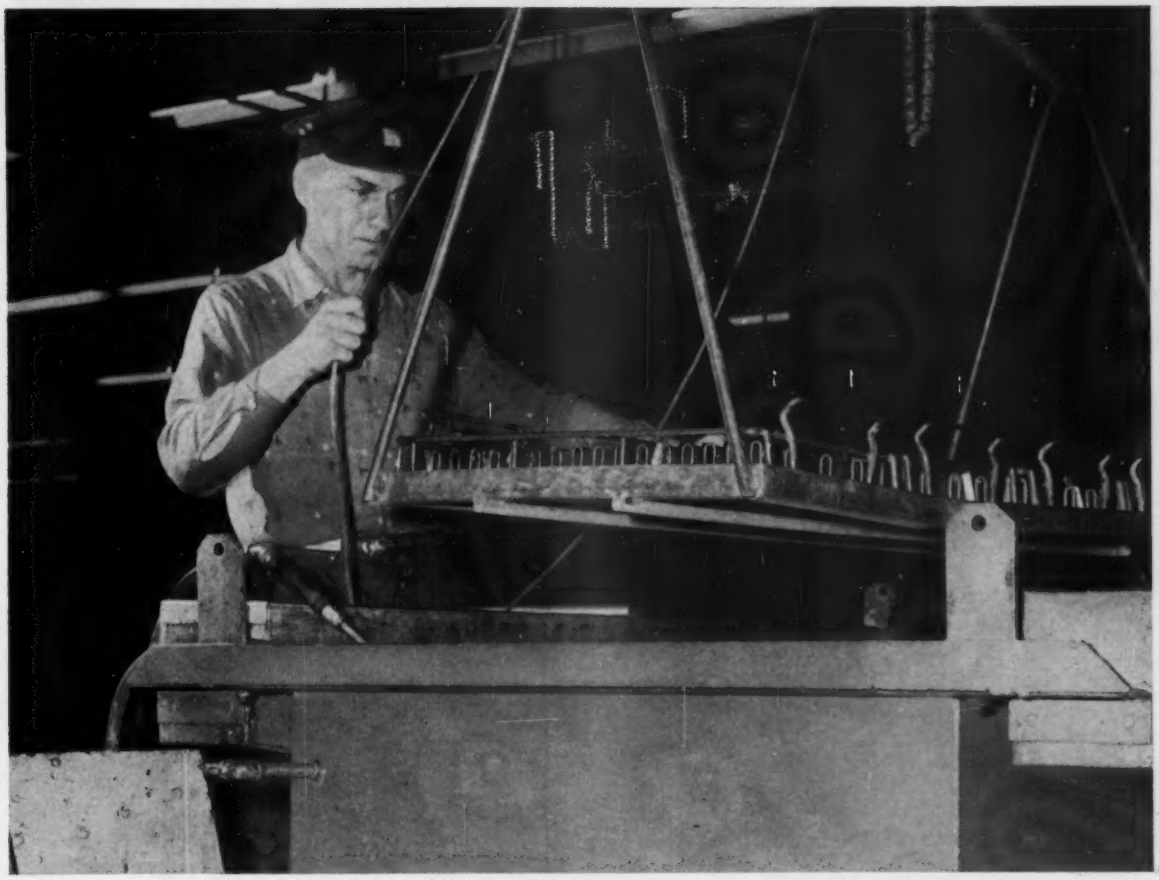
Enjay is a convenient source of basic chemical raw materials for most industrial and chemical needs. Enjay will supply tank cars of MEK, MIBK or will split tank cars for your convenience. Contact Enjay at 15 West 51st St., N.Y. 19, N.Y.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

ENJAY
PETROCHEMICALS



WHERE HOOKER TRICHLORETHYLENE RAISED QUALITY AND LOWERED COSTS

Approximately a year ago, the Metals Processing Division, Curtiss-Wright Corporation, began using high-quality Hooker NIALK® TRICHLORETHYLENE to degrease jet engine blades. Before this, maintaining purity in the baths required frequent cleanouts. Chemical costs were high.

Immediate results with Nialk showed a better cleaning job and tighter quality control. Down time for degreaser maintenance has been substantially reduced.

The exceptional cleaning results now obtained permit inspectors to discover possible flaws more easily. Maintaining quality is far less difficult.

The stabilizer in Nialk TRICHLOR contains *psp*—permanent staying power—which enables the stabilizer to operate efficiently until cleanout. After cleanout, the solvent is distilled for further use in other operations.



Curtiss-Wright officials say that the assistance they obtain from Hooker technical experts in preventing waste is most important, since they are working with costly metals. Because the degreasing baths have never turned acid, problems in keeping their quality at a high level and the necessity to run tests have been reduced. Whatever your degreasing job or the type of metal you're processing, Nialk TRICHLOR can give you a greater volume of work and reduce your costs, as well as provide a smooth-running operation.

Contact your nearest Hooker Chemical Distributor for information. Or write us. We will be glad to help you with any problems.

HOOKER CHEMICAL CORPORATION

1306 UNION STREET, NIAGARA FALLS, NEW YORK

HOOKER CHEMICALS PLASTICS

Sales offices: Buffalo, Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass. *In Canada:* Hooker Chemicals Limited, North Vancouver, B.C.



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COLOR PASTES

for EPOXY RESIN Compounds

from a long established, reliable, centrally located Chicago manufacturer

The Most Complete Line of Tailor-Made

EPOXY COMPOUNDS

Code No.	Name
2-M-302	Plastic White
2-M-303	Permanent Black
2-M-304	Primrose Yellow
2-M-305	Orange
2-M-306	Glass Green
2-M-307	Blue
2-M-310	Mercadium Red

The vehicle portion of all the Epoxy Dispersions employs the finest quality (100% solids) liquid Epoxy Resin on the market today. All colorants used have excellent resistance to color change due to the effects of light and heat.

Special shades of color dispersions can be manufactured for quantity users. Every user of Epoxy Compounds or Resins should carry a line of CLINCO Epoxy Dispersions. This will enable you to transform any color of Opaque Epoxy Compound which you are now using into a variety of bright colors.



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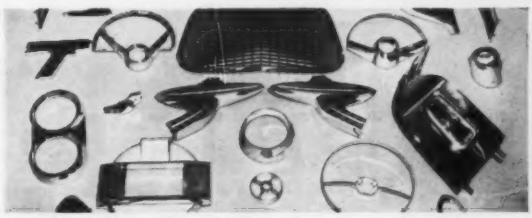


This mirror-finish chrome plating starts with smooth deposits from OFHC® Copper Anodes

The mirror-bright finish of these high quality chrome-plated parts reflects the superiority of their base coating . . . OFHC Brand Copper. The Electric Autolite Company at its plant in Woodstock, Illinois, finds that OFHC Anodes form denser, more uniform copper coatings on their automotive zinc die castings that require practically no buffing. As a result, production costs are cut while subsequent plating with nickel and chrome is naturally easier.

OFHC ANODES ARE IMPURITY-FREE

OFHC Anodes provide smoother finishes because they are 99.99+% copper, the purest copper anodes produced, completely free of oxides and residual deoxidants. Purity and density result in more uniform anode dissolution . . . plating free from roughness caused by impurities or insoluble copper particles.

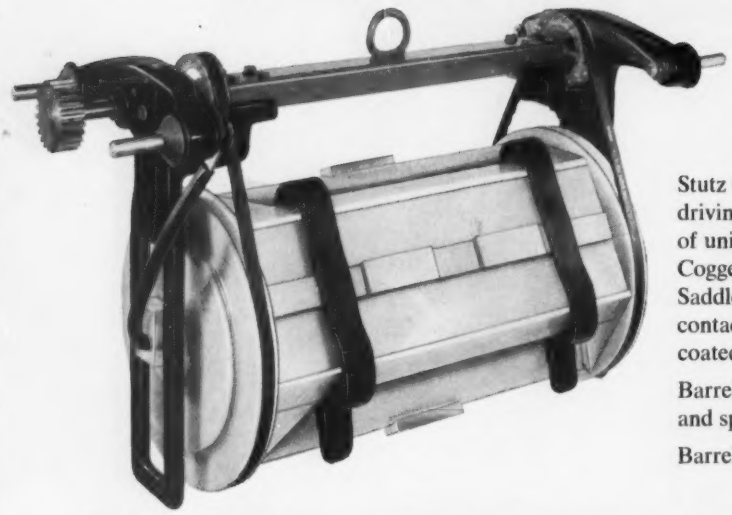


OFHC Copper smooths the way for quality chrome finishes.

Free technical publications to help you obtain better plating are available from your OFHC Anode Distributor, or directly from AMCO Technical Service Section. Ask for them today.

AMCO
a division of American Metal Climax, Inc.
Rockefeller Center, New York 20, N. Y.

The NEW STUTZ Plating Barrels



ORIGINATOR OF

1. **LOW HEADROOM DESIGN**
2. **COMPLETELY COATED HANGER ARMS**
3. **QUICK CHANGE BELTS**

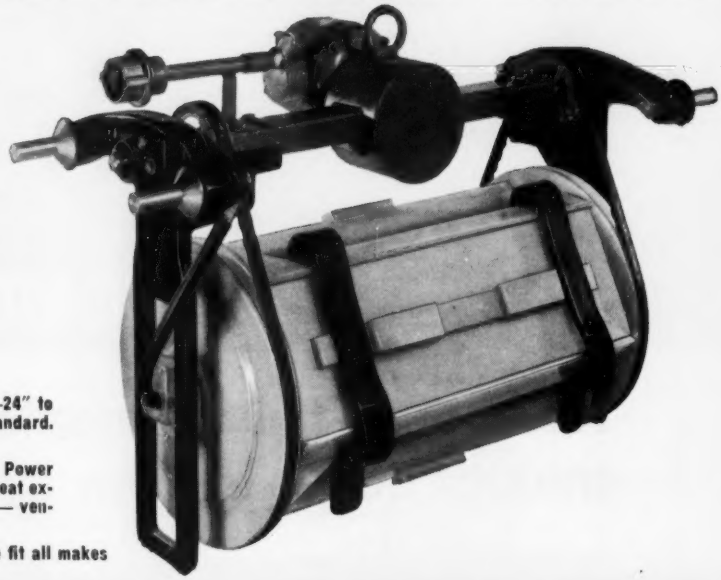
Stutz Complete Cycle Assembly for operation in tanks with driving mechanism located externally. Lifting and lowering of unit reduced to a minimum. Barrel is totally submerged. Cogged drive belts can be changed in seconds without tools. Saddle horns are 1" or 1¼" diameter. Cathode dangler type contacts are standard, with others available. Hanger arms coated with Vulcanized Hard Rubber or Rigid Plastisol.

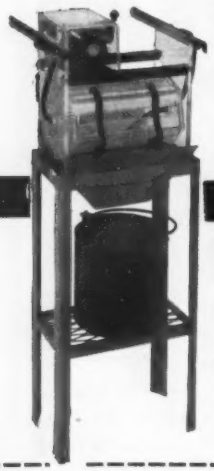
Barrels can be supplied in special sizes, also with partitions and special contacts as required.

Barrel assembly units are made to fit all makes of tanks.

. . . NEW MATERIALS • POLYPROPYLENE • PLEXIGLAS • TEMPRON • MELAMINE . . .

Barrel rotation in this design is provided by motor drive mounted directly in superstructure bridge member. Fast handling as total weight and overall height have been greatly reduced. Barrel transported from one operation to the next under continuous rotation. Solution dragout is reduced to a minimum. Rinsing time following alkali cleaning, acid pickling, etc., is greatly reduced. Overall dimensions of the tank are lessened by the elimination of motor drive platform. Electric service is 440, 220, or 115 volt with grounded cable and Hubbell-Twist Lock heavy duty safety connector.





Sizes 12" to 18" inside diameter—24" to 42" long—perforations 3/32" standard. All other sizes available.

Tanks in single and multiple — Power equipment — dryers — filters — heat exchangers — chemicals — anodes — ventilation, etc.

Barrel assembly units are made to fit all makes of tanks.

STUTZ *Portable Plating Barrels*

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x20" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

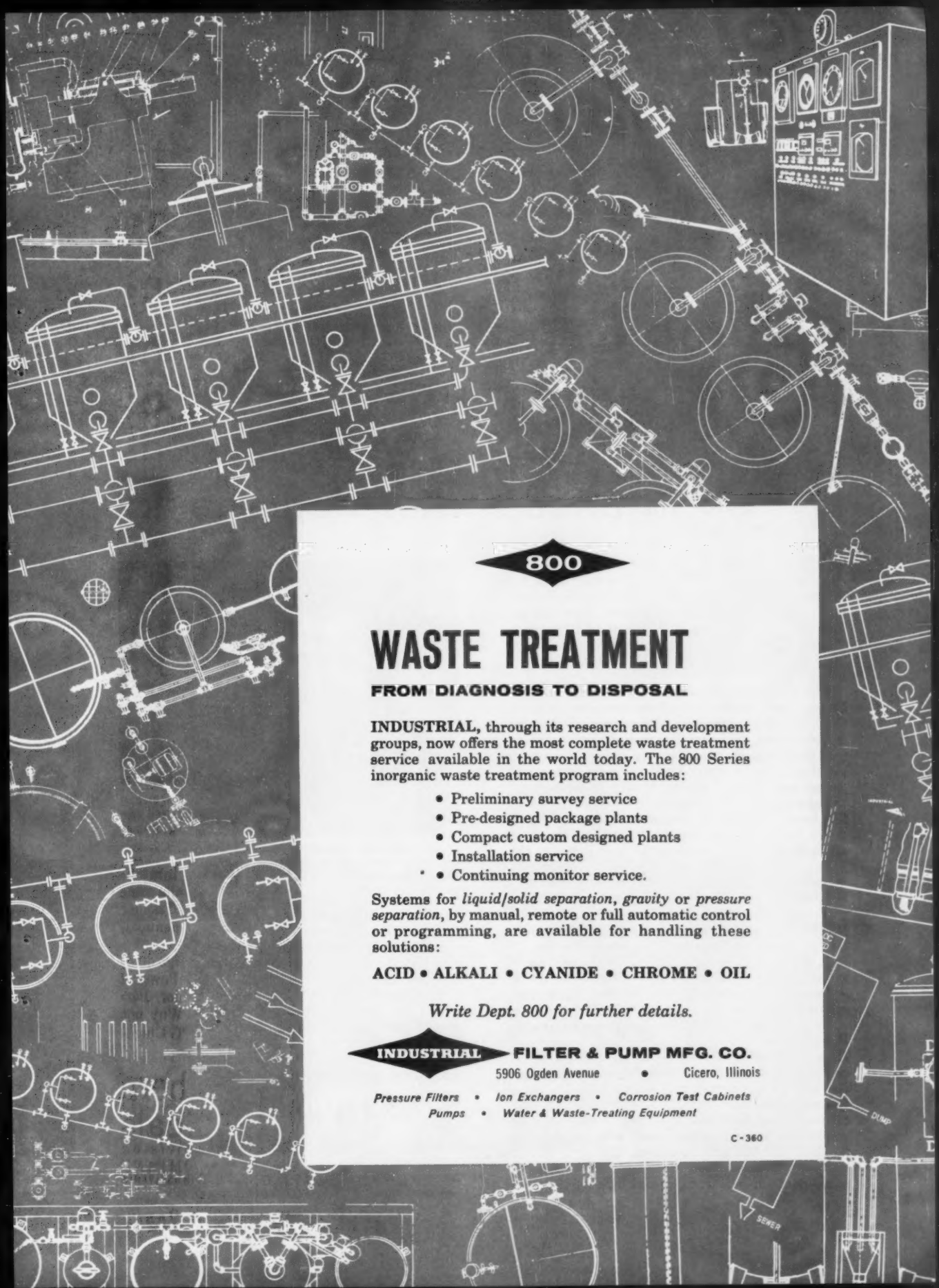
- **Baskets in perforated metals or wire mesh.**
- **Load/Unload Stand for convenient and fast handling of work load.**

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- Continuing monitor service.

Systems for *liquid/solid separation*, *gravity* or *pressure separation*, by manual, remote or full automatic control or programming, are available for handling these solutions:

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Write Dept. 800 for further details.

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Pressure Filters • Ion Exchangers • Corrosion Test Cabinets
Pumps • Water & Waste-Treating Equipment

C-360

Ready-Power switches to **Columbia-Southern Trichlor** to solve corrosion problem and save equipment in used motor degreasing

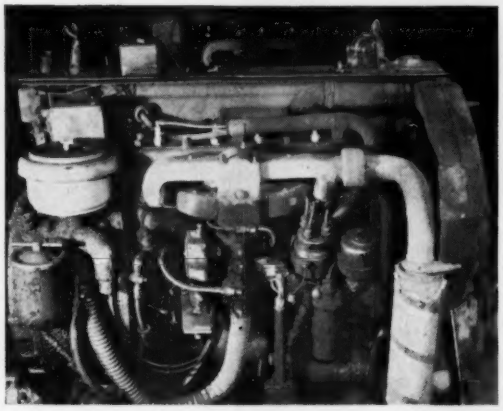
The Ready-Power Company of Detroit manufactures gasoline and diesel electric power units for fork-lift trucks, crane trucks, platform trucks and other materials-handling equipment. They also repair and rebuild used power units which have spent years in the most rugged kind of service. And this is where Columbia-Southern TRICHLOR comes into play.

The used power units, as received by Ready-Power, have been exposed to corrosive residues from fuel and lubricating oils, carbon black, salt, foundry dust, acid pickling materials and similar soils from virtually every type of industry. In service these contaminants build up a thick layer of grease and "gunk." Before Ready-Power's maintenance experts can diagnose and repair the units, the heavy coating of contaminants must go. A vapor degreasing operation proved to be the most efficient method of removing all soils down to the metal, without harm to any of the parts or surfaces.

Soon after installing the vapor degreasing system, though, Ready-Power ran into a problem. The solvent they were using soured rapidly, due to the combination of materials the used power units had picked up in their years of heavy service. In fact, the active acid content of the solvent built up so quickly that it was corroding the tank. In a short time, replacement of the new equipment might be required.

At this point, the Trichlor distributor in Ready-Power's area—Progressive Chemical Company of Detroit—teamed up with the maintenance and production people at Ready-Power to eliminate the source of equipment corrosion. Because Columbia-Southern Trichlor has a heavy-duty stabilizer system built into it for just such operating conditions, the degreasing system was charged with Trichlor and put into operation.

Result: The corrosion which threatened to cause equipment replacement stopped immediately and had never resumed since *neutral* Columbia-Southern Trichlor has been on the job. Units come clean—fast and economically—thanks to Trichlor and helpful service from Progressive Chemical, the distributor.

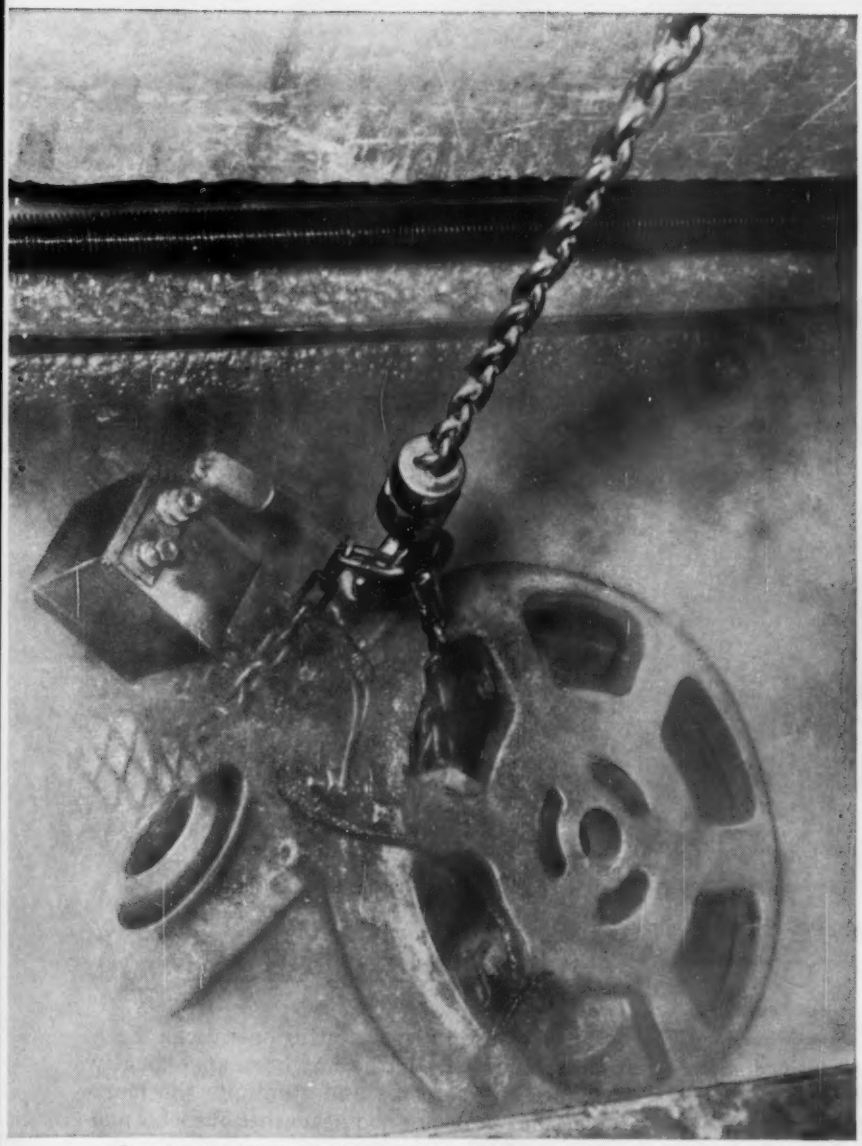


Ready-Power must remove this heavy accumulation of grease, dirt and acidic soil before diagnosing and repairing used unit. Degreasing is the answer to low-cost, safe cleaning of units returned for service.

It's help like this, plus the consistently high quality of the product, that makes Ready-Power a steady user of Columbia-Southern Trichlor. Perhaps *your* operation could benefit, too. Why not call on your Trichlor distributor or the PPG Chemical Division office nearest you?

columbia | southern chemicals

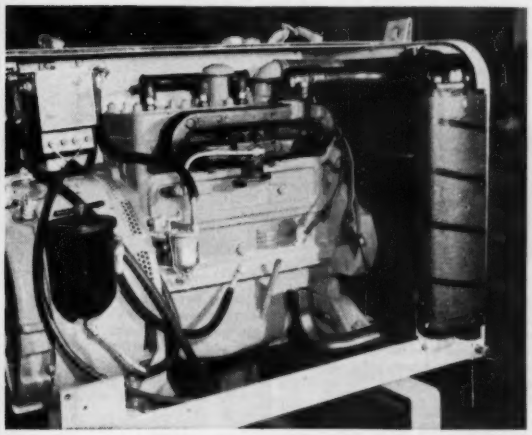
CHEMICAL DIVISION
PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER PITTSBURGH 22, PENNSYLVANIA



Complete electric generator in vapor phase of Trichlor solvent.



Columbia-Southern Trichlor safely removes contaminants, yet protects the equipment with its heavy-duty neutral stabilizing system.



Rebuilt power units leave Ready-Power in first class condition; all defective parts repaired or replaced, and carrying the same warranty as new units.



Peter Balysh (right) of Ready-Power, and Rodger Lau, Columbia-Southern Trichlor Distributor, inspect soil conditions on a unit turned in for repair.

NUODEX introduces



a series of new high-performance plating baths to complement NUODEX certified plating chemicals.

Two years ago, Nuodex led the industry in bringing you the many advantages of certified metal purity and quality in nickel plating chemicals. Now, with the introduction of high-performance plating baths and brighteners, Nuodex offers you improved control in your plating operations. Each of these four new baths has been specifically developed to overcome and eliminate the more troublesome problems and headaches of nickel and copper production plating.



A new bright nickel process with high leveling properties, high throwing power, ease of control, excellent ductility. May be used with agitated or still bath processes.



A bright barrel process, it may be used in hot barrel solutions or in room temperature baths with equal effectiveness. Simple to maintain and control, it produces highly uniform, bright deposits.



Specifically designed to eliminate stress problems in nickel deposits, it acts as a modifier to reduce high tensile stress to zero or convert it to compressive stress. Produces extremely ductile plate.



This acid copper process has high throwing power, eliminates rough grainy deposits and "treeing" while promoting smooth, hard deposits of high ductility at rapid speeds.

This new line of high-performance plating baths is backed up by qualified and experienced technical and laboratory facilities, as are other Nuodex quality chemicals.

NUODEX

CERTIFIED THRO-KOTE PROCESS

(Patent Pending)

A bright nickel process having exceptional leveling properties, excellent throwing power, soft ductile deposits and ease of control. By using different wetting agents, this bath can be operated either as a still bright nickel or as an air agitated bright nickel process.

Properties

- Excellent throwing power.
- Fast brightness-building quality.
- Clean white bright deposit.
- Exceptional leveling properties.
- High degree of ductility.
- Wide current density, temperature and pH range.
- Good corrosion protection.
- Good tolerance to impurities.
- Good acceptance of subsequent chrome, gold or nickel plating.
- Economical operation.



For complete technical data, write for your copy of Bulletin TK-1 on your letterhead.

NUODEX

CERTIFIED BAR-L-KOTE PROCESS

(U.S. Pat. No. 2,228,991)

A bright barrel nickel process offering the unique advantage of working equally well in either hot barrel nickel solutions or in room temperature baths. The nickel salt content offers a wide range of concentration, thus minimizing analytical supervision. Heavy deposits can be rapidly built up, using a high temperature bath, without any brightener breakdown.

Properties

- Can be used in cold solutions for decorative deposits or hot solutions for specification deposits.
- Excellent uniform white bright deposits on small parts.
- Deep penetration into recesses.
- Heavy metal build-up over a wide operational range.
- Deposit of very ductile plate.
- Receptive to chrome plating.
- Extremely small addition required for effect.



For complete technical data, write for your copy of Bulletin BK-1 on your letterhead.

NUODEX

CERTIFIED FLEX-KOTE PROCESS

(U.S. Pat. No. 2,409,119)

A semi-bright nickel process developed to minimize problems caused by tensile stress in nickel deposits. Stress can be modified to a lower tensile stress or maintained at zero or converted to compressive stress. Such compressively stressed deposits overcome deformation and brittleness problems which occur when using a normal bath.

Properties

- Controlled stress plating deposits nickel under neutral or compressive stress.
- Deposits have excellent grain structure and ductility.
- Nickel deposits are of high purity.
- Excellent corrosion resistance.
- Provides an extremely receptive surface for precision plating of gold, rhodium and other noble metals.
- Increases hardness of deposited nickel while maintaining ductility.
- Offers great accuracy in electroforming of dies.
- Only one additive required to convert or control a bath.
- Plating through a wide range of current density.
- Less tendency to breakdown or form organic contamination.
- Operation in wide pH range without change in color of deposit.



For complete technical data, write for your copy of Bulletin FK-1 on your letterhead.

NUODEX

CERTIFIED COP-R-THRO PROCESS

(U.S. Pat. No. 2,871,173)

An economical process used in an acid copper media, it greatly increases throwing power of the copper electrolyte for even deposits in blind holes and crevices. Has incomparable ductility, promotes ease of buffing. Practically eliminates the need for periodic reverse or "deplating" to insure smooth even deposits.

Properties

- Exceptional throwing power permits plating through holes in printed circuits.
- Produces ductile deposits.
- Produces smooth, readily buffed deposits.
- Produces 75 hardness on Rockwell "F" scale.
- Produces 41,000 psi tensile strength deposits.
- Minimizes "treeing" and nodular build-up.
- Increases plating speeds up to 200%.
- Permits use of wide current density range.
- Inexpensive to use and economical to maintain.
- Easy to control.

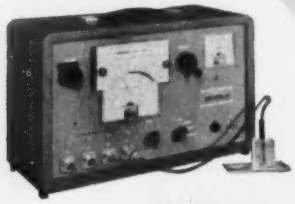


For complete technical data, write for your copy of Bulletin CT-1 on your letterhead.

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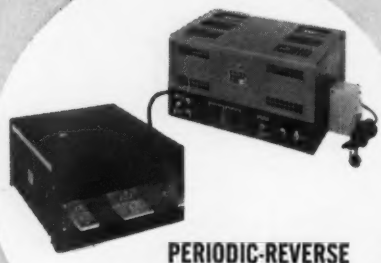


DERMITRON
NON-DESTRUCTIVE
COATING THICKNESS
TESTER

MEASURES METALLIC AND NON-METALLIC COATING THICKNESS

The DERMITRON instantly and accurately provides direct readings of metallic and non-metallic coatings and films. It is widely used and recommended for measurement of such coatings as: CADMIUM or ZINC on steel; SILVER on brass; ANODIZING, HARDCOAT, PAINT on aluminum, magnesium, etc.

Very simple to operate, the DERMITRON is compact, offering portability for both laboratory and production use. Four patented measuring probes are available for extra-wide thickness ranges from thick to thin deposits and enable measurements on small areas and previously inaccessible areas. You can rely on the DERMITRON NON-DESTRUCTIVE TESTER for any application where coating thickness must be controlled. Write for current bulletins and price list.



PERIODIC-REVERSE
AND CURRENT-INTERRUPTION
UNITS

PERIODIC REVERSE UNITS are used with ALKALINE DERUSTING and DESCALING processes for more efficient and effective cleaning operations. Write for Bulletin PR-AD-1.

PERIODIC-REVERSE and CURRENT-INTERRUPTION UNITS—for PLATING of SILVER, COPPER, GOLD, BRASS, etc., this fine electronic equipment saves time, money and improves quality. It makes deposits smoother . . . faster . . . brighter . . . easier to polish . . . less porous . . . more uniform. And it's extremely simple to install and operate. Write for current Bulletin PR-3 and prices.

All requests for complete details are processed quickly.

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UPA

Gordon Research Conference On Electrodeposition

W. R. Meyer — Co-Chairmen — *M. S. Frant*

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TILTON SCHOOL
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July 31 - August 4, 1961

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Monday

Morning—The Mechanism of Electrodeposition — *W. R. Meyer*, Chairman
Evening—The Mechanism of Electrodeposition (Continued) — *E. B. Saubestre*, Chairman

Tuesday

Morning—The Mechanism of Electrodeposition (Continued) — *N. Hackerman*, Chairman
Evening—Addition Agents in Electrodeposition — *O. Kardos*, Chairman

Wednesday

Morning—The Effect of Structure on Properties. (A) Basis Metal Structure — *A. Brenner*, Chairman
Evening—The Effect of Structure on Properties. (B) Coating Metal Structure — *A. Brenner*, Chairman

Thursday

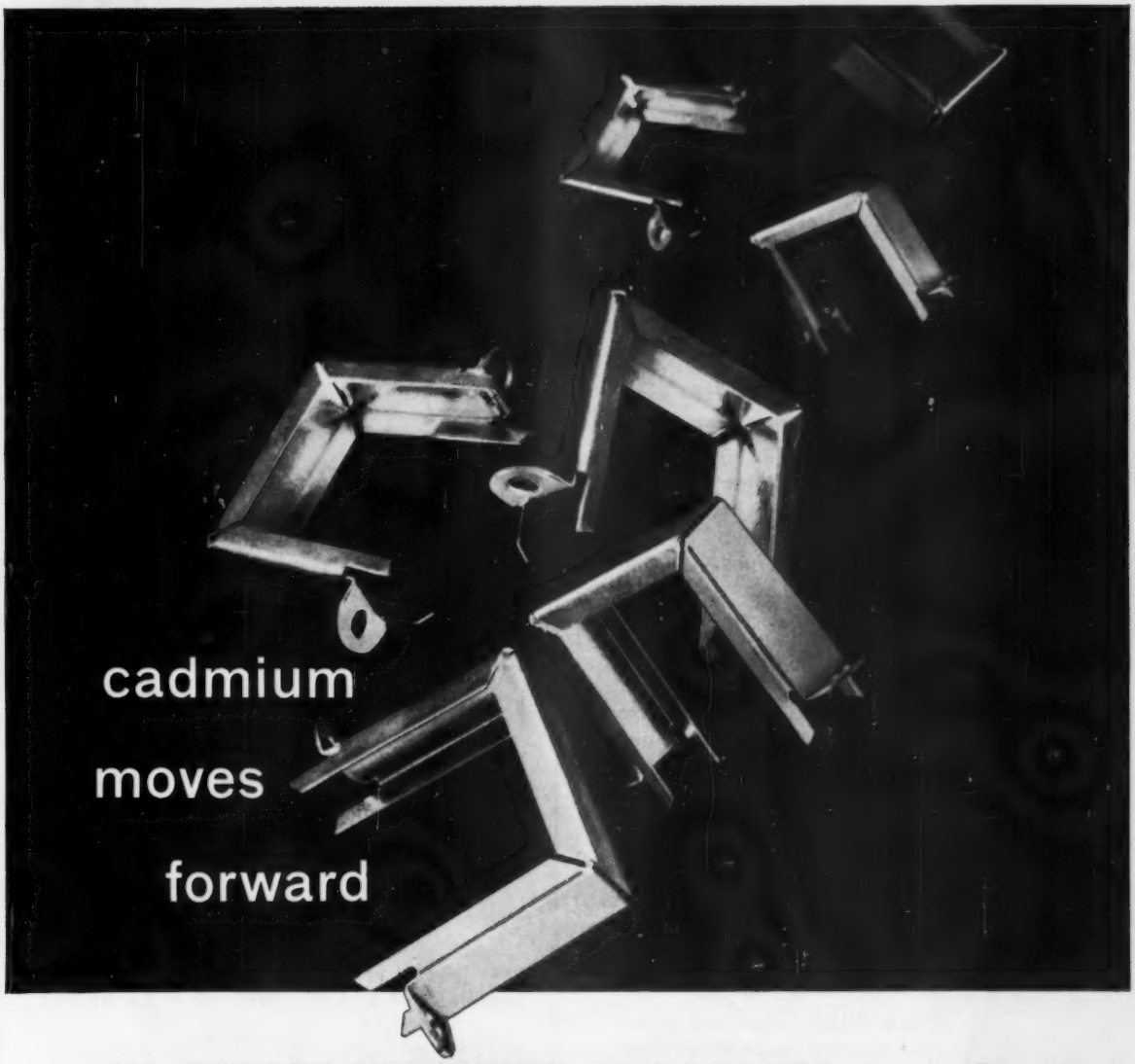
Morning—Electrodeposition of Alloys — *F. A. Lowenheim*, Chairman
Evening—Electrodeposition on Unusual Substrates — *H. B. Linford*, Chairman

Friday

Morning—Current Problems in the Utilization of Plated Coatings — *N. Murphy*, Chairman

Attendance at the conference by application and limited to approximately 100 conferees. Requests for attendance or additional information from:

W. GEORGE PARKS, *Director*
Colby Junior College
New London, New Hampshire



...with FINEST FINISHING PROCESSES from Cowles

Your products gain the full benefit of cadmium corrosion resistance with Cowles cadmium brighteners. For truly bright finishes, even in low current density areas on intricate shapes, Cowles provides a simplified *sure* way to improve your cadmium plating results.

Cowles' complete plating services go far beyond cadmium brighteners. You can depend on Cowles products and processes for every phase of cleaning, phosphating, conversion coating, coloring and final protection. Your Cowles Technical Man can demonstrate immediate improvement in your own operation with Cowles Finest Finishing Processes. Take advantage of it — call Cowles today!

applications for all types of metals, equipment and procedures

- Cleaners — soak, barrel, electro and spray
- Phosphate coatings — crystalline and amorphous
- Brighteners for zinc, cadmium and copper plating
- Conversion coatings — aluminum, cadmium and zinc
- Protective coatings for all plated surfaces
- Foam blanket and surface tension fume suppressants
- Acid additives and salts
- Aluminum cleaners, etchants and deoxidizers
- Basic plating electrolytes
- Industrial cleaning and pickling chemicals

Cowles CHEMICAL COMPANY
CLEVELAND 20, OHIO

COATINGS
for Zinc and Cadmium



KER-CHRO-MITE #2 produces LUSTROUS finish with maximum protection against corrosion for ZINC & CADMIUM.



KER-CHRO-MITE #4 produces mirror-bright finish on ZINC & CADMIUM. Ideal for fully automachines or manual vats.

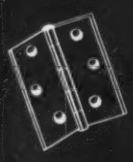


KER-CHRO-MITE #5 is single step Chromate bright dip, for ZINC or CADMIUM, supplied in concentrated form. Will produce a lustrous finish, in a SINGLE DIP. Has excellent life.

KER-CHRO-MITE B brightens and passivates BRASS, COPPER and BRONZE.



KER-CHRO-MITE GC produces olive drab on CADMIUM and ZINC plate and its alloys. Has maximum protection AGAINST CORROSION. Excellent as paint base.



ZIN-K-LUX-D a newly improved ZINC sol. brightener and purifier. Produces lustrous finish right out of the tank. Compatible with almost all addition agents.

ZIN-K-PURE inexpensive leveler and purifier for CYANIDE ZINC solution.



CADLUX-D improved brightener for CADMIUM solution. Needs only a small amount for lustrous Still or BBL plating.

BOOSTER-BRITE for CYANIDE, ZINC and CADMIUM baths. Assists organic brighteners and PRODUCES FOAM BLANKET.



BLACKENING SALTS for CADMIUM or ZINC. Produces jet black finish.

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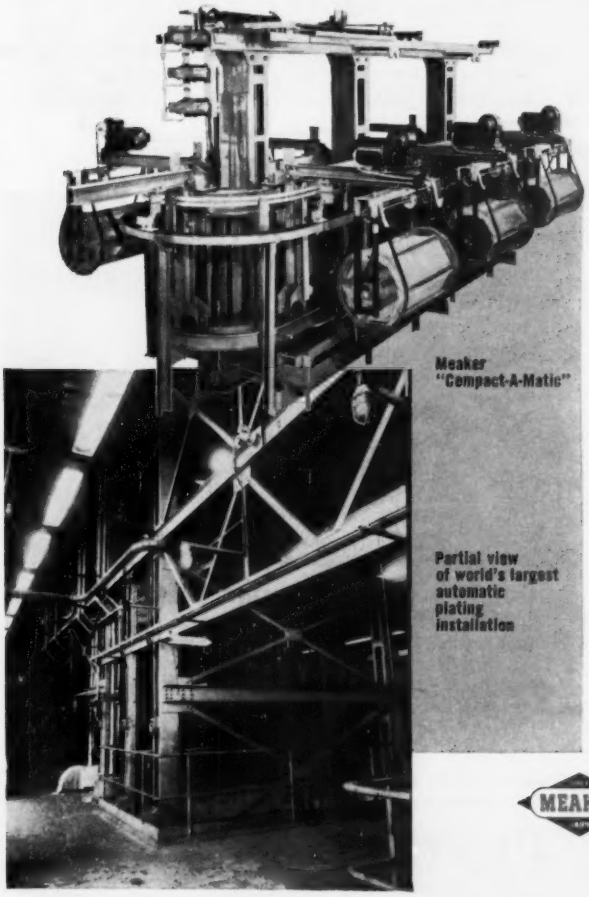
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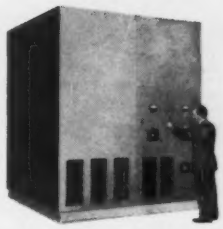
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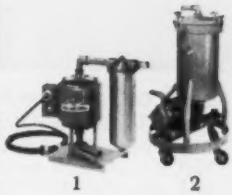


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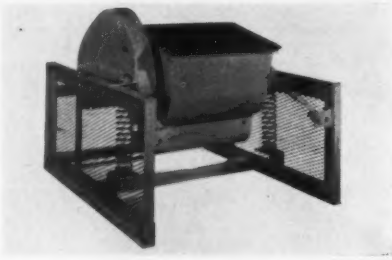
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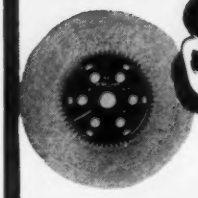
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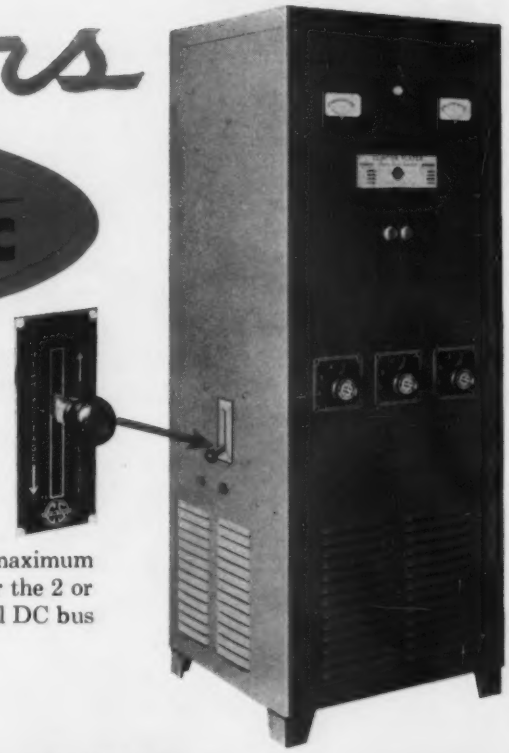
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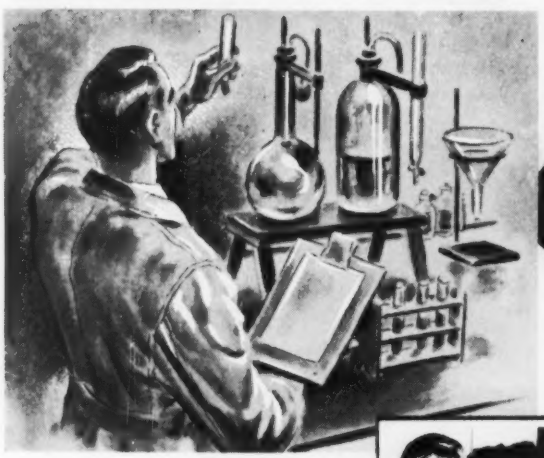
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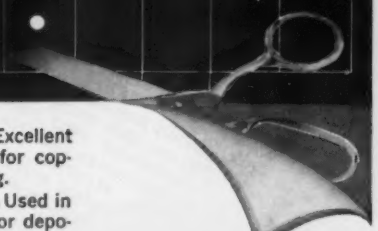
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POLISHING	●	●	●	●	●	●	●	●		●			
PICKLING	●		●	●	●		●			●		●	
ELECTROPLATING	●	●	●	●	●	●	●	●		●	●	●	●
ELECTROPOLISHING	●						●						
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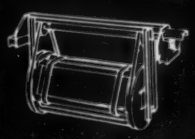
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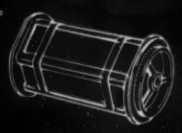
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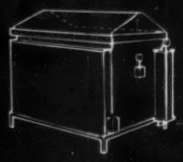
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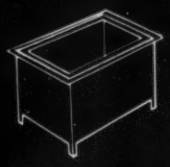
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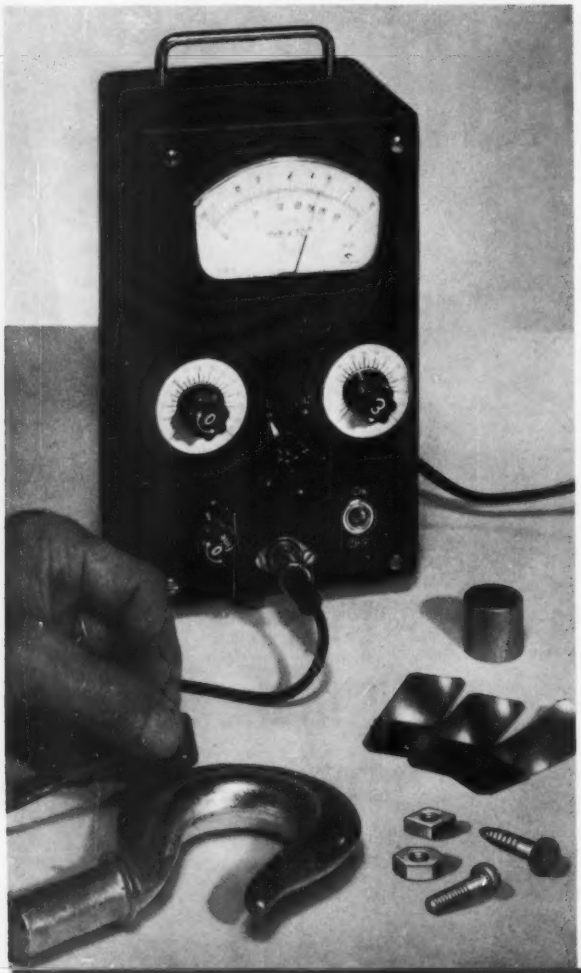
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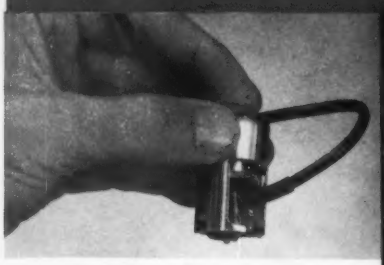
TYPE ES NONDESTRUCTIVE THICKNESS TESTER for gaging coatings on IRON and STEEL

OVER 1,001 WAYS USEFUL: Provides a nondestructive means of measuring the thickness of organic and nonmagnetic metal coatings (including phosphates and Kanigen) with the accuracy of the microscopic method. Ideally suited for difficult measurements such as on piston rings, thin wire, screws, case hardened parts, etc. — *many of which cannot be performed successfully with other testers currently available.* Nonferrous foils and films (such as plastic, aluminum, mica, etc.) can also be measured when placed on a smooth, ferrous plate.

EASY TO OPERATE: Unit is compact and portable. Measures 5¼" x 8¾" x 5". Can be utilized wherever an 110 volt AC outlet is available. Features small, 2-pole probe which works on principle of magnetic amplifier. To measure the thickness of a coating, the probe is simply placed in contact with surface.

BUILT-IN "MEMORY": Hardened beryllium copper foils in accurately-determined thicknesses are furnished for calibrating the instrument. Once the Permascope has been calibrated for a test specimen, control dials can be re-set for the same part without recalibration.

ACCESSORIES THAT INCREASE THE VERSATILITY OF THE TYPE ES PERMASCOPE



CONSTANT PRESSURE ATTACHMENT

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PISTON RING FIXTURE

A holding fixture can be furnished for accurate measurement of plating thicknesses on piston rings. The Permascope is the only instrument that can be used for this purpose on a production basis.

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TYPE EC2T4 NONDESTRUCTIVE THICKNESS TESTER for gaging coatings on NONFERROUS METALS

The PERMASCOPE Type EC2T4 has been specifically calibrated to gage nonconductive coatings, but can be adapted to measure thicknesses of nonferrous metal coatings on nonferrous base metals, and conductivities of nonferrous metals.

The PERMASCOPE EC can also be used for thickness measurements of metal foils. Furthermore, it will measure the thickness of metal coatings applied on a nonconductor, such as copper on phenolic (printed circuits) or vapor deposited aluminum on plastic sheets.



Developed by Twin City Testing Corp. for Alcoa Research Labs this model EC2T4 PERMASCOPE enables aluminum finishes to be produced with a maximum of quality and durability at the lowest possible cost. PERMASCOPES have now been installed in twenty Alcoa plants and laboratories, in the plants of six Alcoa licensees, as well as in plants and laboratories of other aluminum producers and finishers.

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Lightweight (less than 12 lbs.), compact and versatile, the PERMASCOPE permits thicknesses of coatings to be checked in seconds—accurately and nondestructively—wherever there is an electric outlet. For obvious reasons only the nondestructive method is suitable for use in the total inspection of completed components. The PERMASCOPE does not require technically trained personnel and the readings obtained are quick and microscopically accurate.

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A Warning To Prospective Buyers of Used Plating, Polishing or Painting Equipment

Don't Invest A Single Dollar Before Checking These Important Pre-Purchase Pointers

If you are considering the purchase of used or rebuilt equipment for your plant, experience has taught us that it is either because you are interested in the cost savings involved as compared to new equipment, or delivery of new equipment is a problem. Whichever your motive may be, you would be wise to weigh the possible pitfalls of this type of investment before you have course to regret your decision to "buy it re-built".

Selecting Your Source... The First, Most Important Step

Over the past few years literally dozens of used and rebuilt equipment "dealers" have sprung up who "specialize" in metal finishing machinery. Many of these concerns are fine, reputable organizations, others are merely brokers with no inventory on hand, without rebuilding facilities and financial responsibility. To the prospective buyer who investigates before he invests and is not misled by what may appear to be a bargain, these "companies" simply don't rate as sources to be taken seriously. For the sake of comparison, check the assurances that we offer here at J. Holland & Sons, Inc.

Reputation... Does It Really Mean Anything?

We think so. Since 1905 we have supplied metal finishing plants in 41 states and 16 foreign countries with every conceivable type of rebuilt equipment from air compressors to zinc plating installations. Each unit shipped out of our plant is completely rebuilt and accompanied by a meaningful guarantee. Our customers have learned that we deliver what we promise at the price we promise.

Without the men and machines for legitimate rebuilding operations, without the plant . . . used equipment usually ships out as old equipment with a new coat of paint and a shiny name tag. Here at J. Holland and Sons, Inc., 7500 square feet of our plant are devoted to a completely equipped machine shop and electrical shop. These departments are expertly staffed with over 30 men, many of whom have been with us for over 20 years. In many cases equipment we sell is not as "good as new". . . it's "better than new."

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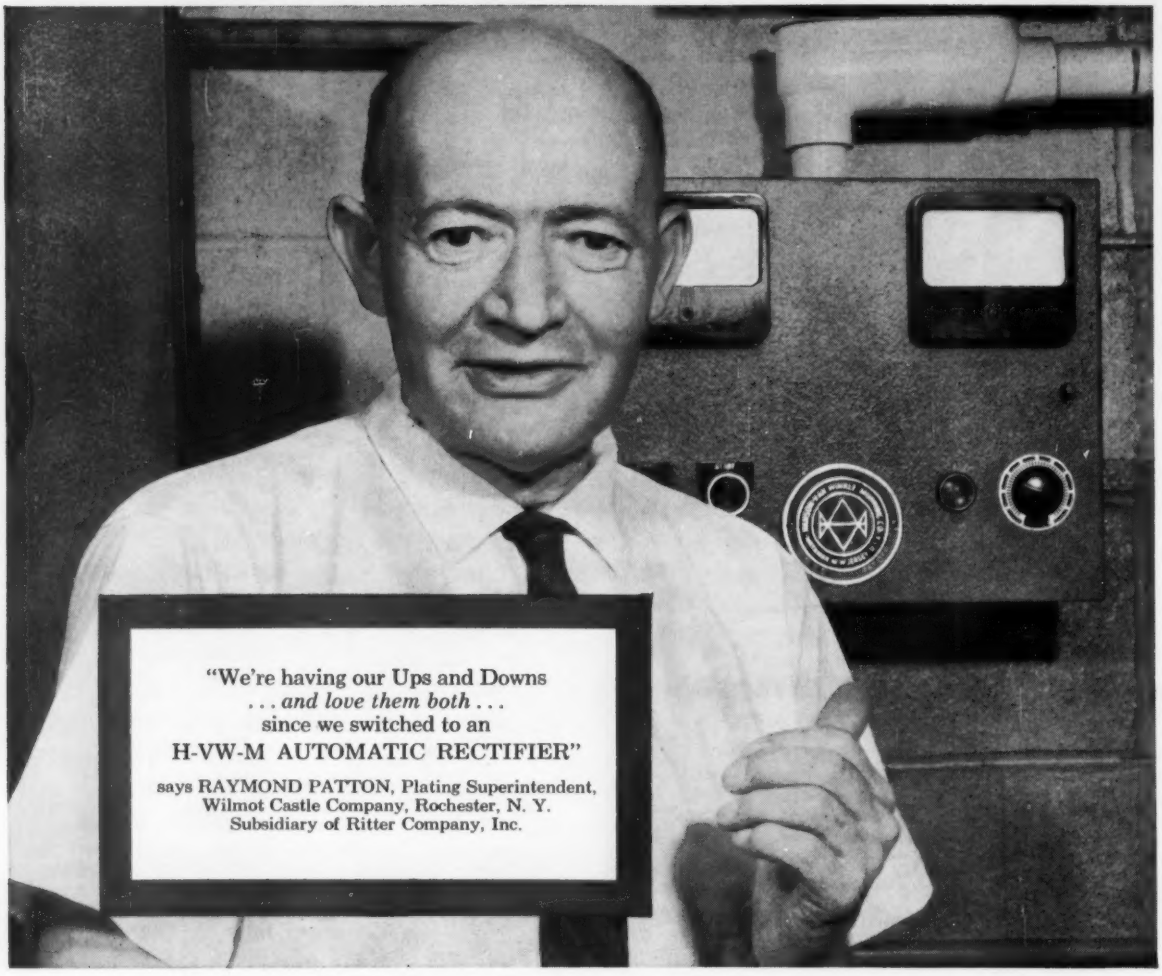
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Metal Finishing

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JUNE, 1961 Volume 59 No. 6

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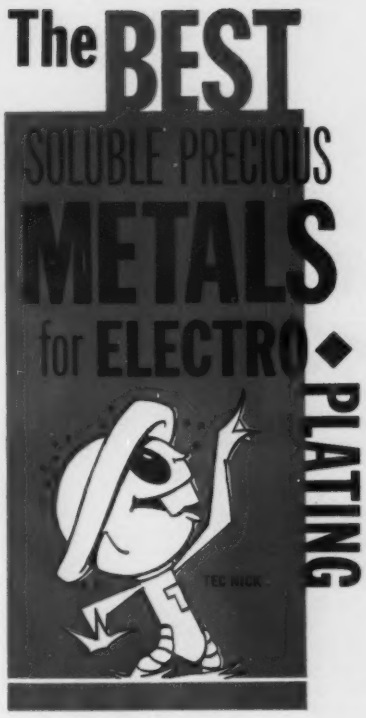
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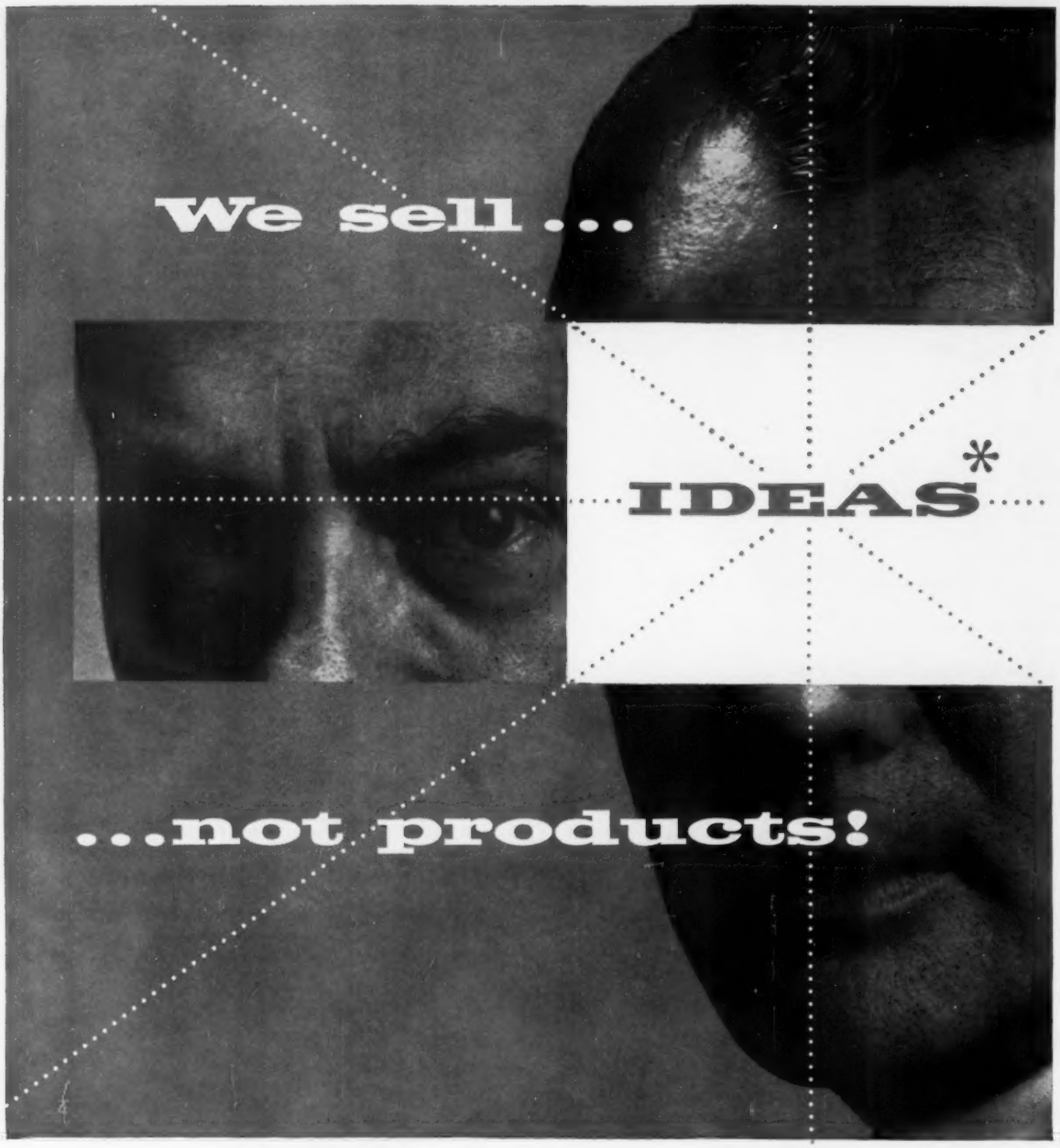
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ESTABLISHED 1903 VOLUME 59 • NUMBER 6 • JUNE, 1961

Off to Boston . . . .

On June 18-22, the forty-eighth annual convention of the *American Electroplaters' Society* will be held in Boston, Mass. Last year, in Los Angeles, a highlight of the meeting was a symposium on hydrogen embrittlement which, alone, made the trip worth while for many finishers. Not to be outdone, the Boston committee has arranged an all-day session this year on finishing of the light metals which, we predict, will be just as rewarding to those fortunate enough to be present.

Plating, anodizing, and conversion coating of aluminum and magnesium will comprise only one-quarter of the papers to be presented. A glance at the technical program published in this issue of *Metal Finishing* will indicate the scope of the subject matter to be discussed. No matter what area of the industry any particular finisher is concerned with, whether it be organic coating, decorative and protective plating, electroforming, or printed circuits, he will take home with him information of inestimable value.

Each year we have had occasion to point out the benefits which justify attendance at these conventions. There is no need to dwell on the possibilities for intellectual enrichment, a favorite phrase, or on the opportunities to discuss problems with fellow practitioners and to learn new techniques, in addition to making and renewing contacts. The historical significance of the "city of the bean and the cod" is sufficient assurance that the women and children will be pre-occupied to an extent which should completely relieve the mind of all fears of their being bored. Because many nationally-famous manufacturers are located in its environs, a rare opportunity for plant visitations accompanies the convention registration badge. This is a most important consideration because in no other way can the finisher learn more about modern plant operation.

Since these comments are being penned as we prepare to leave for the annual meeting of the *Institute of Metal Finishing*, it occurs to us that there is another very good reason. Boston is not known as the "Hub" without reason. Serviced by excellent superhighways, railroads, airlines, and by boat too, what convention city could be reached more conveniently? If our British counterparts are willing and anxious to travel to a small resort town in the northwest corner of Wales, and the advance registration proves that they are, anything but a record attendance in Boston can only indicate that the British are more dedicated to the art of metal finishing and are more concerned with its future than we are.

Nathaniel Hall

A. E. S. TO HOLD 48th ANNUAL CONVENTION

BOSTON, JUNE 18 - 22



Dr. W. A. Wesley
President, A.E.S.



Louis V. Gagnon
General Chairman



Dr. George P. Swift
Co.-Chairman

THE 48th Annual Convention of the American Electroplaters' Society to be held in Boston, June 19-22 will feature technical sessions on the finishing of light metals, plant visitations to nearby firms doing varied types of finishing, and a full social program that will appeal to all. The National Association of Metal Finishers, management organization of the contract plating and finishing industry, will once again hold its annual convention and seminars just prior to the AES starting Friday, June 16. Both groups will meet at the Statler Hilton, and in each case participation is open to all regardless of membership affiliation. *Napoleon A. Vigeant* is general chairman of the NAMF convention and *Louis V. Gagnon* of the AES convention.

The Boston area is a center of technical knowledge, both in its famous academic institutions among which are Harvard, the nation's oldest seat of learning, and the Massachusetts Institute of Technology, which has contributed so much to modern science, and the highly specialized industrial concerns which abound. Many of the metal working establishments are concerned with electronics and prominent among these is the Raytheon Mfg. Co. with seven local plants. A plant visitation is planned to the Missile Systems Div. at Andover, which has the largest local facilities for finishing aluminum and magnesium, thus tying-in with the all-day symposium on this subject. *Robert W. Anderson* is general foreman there.

Another well-known Boston concern where a convention visit is planned is the Gillette Safety Razor Co., which has extensive automatic equipment for plating razor parts. *Myer Shapiro* is manager of finishing. *George J. Marotta*, convention technical co-chairman, is with the Western Electric Co. at North Andover, where a plant visit is also scheduled. Automated electronics finishing is the main feature here.

The following firms, although not included in the plant tours, are nevertheless among those of interest in this area. The American Electroplating Co. in Cambridge is said to do more plating on magnesium than anyone in the east. One of the oldest job shops in Boston is Boston Nickel Plating Co., founded by *Dr. Isaac Adams, Jr.*, whose early work in nickel plating is on exhibit at Harvard. The Bethlehem Shipbuilding Div. at Quincy has huge outdoor pickling tanks. Reed and Barton and F. B. Rogers Silver Co. are both well known silverware manufacturers in Taunton. General Electric Co. has a large shop in West Lynn, where *Winston Stover* is finishing engineer. The Attleboro region has many jewelry and precious metal shops, of which L. G. Balfour Co., the insignia and trophy firm, is one of the best known. *Herman Wood* is in charge of finishing. Swank, Inc., largest manufacturer of men's jewelry, is also in Attleboro.

At the annual business of the A.E.S. a number of items mainly concerned with finances will be up for discussion. To prevent further depletion of the society's reserve funds it has become necessary again to increase the per capita tax levied against membership dues, and also to review the operating budget so as to reduce expenses without eliminating essential services. Other proposals include a by-law change so that in the future the person in each branch responsible for the educational program will be known as the Branch Educational Chairman instead of Librarian, as previously. Another change will permit the society to publish books on technical subjects where there is sufficient interest.

General Program

All events are at the Statler Hilton Hotel, Boston, Mass., unless otherwise noted. Eastern Daylight Saving Time applies to all events. Registration fee is $25 per person and $15 per child, with an extra charge of $8.50 for children who attend the banquet, and $1.50 for the concert.

Sunday, June 18

9:00 a.m.—*Headquarters Room*
Executive Board Meeting

11:30 a.m.—*Room 409*
Metal Finishing Suppliers' Assn. Trustees' Meeting

1:00-8:00 p.m.—*Mezzanine*
Registration

2:00 p.m.—*Room 418*
Honorary Membership Award Committee Meeting

2:00 p.m.—*Room 410*
Scientific Achievement Award Committee Meeting

3:00 p.m.—*Bay State Room*
Ladies' Tea

4:00 p.m.—*Headquarters Room*
Credentials Committee Meeting with Executive Board

8:00 p.m.—*Grand Ballroom*
Get-Together Party

Monday, June 19

8:00 a.m.-9:00 p.m.—*Mezzanine*
Registration

9:30 a.m.—*Bus from Statler Hotel*
Children's Bus Outing

10:00 a.m.—*Grand Ballroom*
Grand Opening Session

11:00 a.m.—*Grand Ballroom*
Supreme Society Business Meeting

12:00 noon—*Bay State Room*
MFSA Luncheon and Business Meeting

12:00 noon—*Parlor A*
Branch Secretaries' Luncheon

12:15 p.m.—*Parlor B*
Speakers' Luncheon

12:30 p.m.—*Ballroom Assembly*
Ladies' Luncheon

1:00 p.m.—*Bus from Statler Hotel*
Plant Visit, Keystone Camera Co.

1:00 p.m.—*Bus from Statler Hotel*
Plant Visit, Boston Globe

2:00 p.m.—*Grand Ballroom*
Opening Educational Session

2:30 p.m.—*Parlor C*
Editorial Board Meeting

2:30 p.m.—*Grand Ballroom*
Educational Session A

2:30 p.m.—*Georgian Room*
Educational Session B

4:00 p.m.—*Hancock Room*
Order of Past Presidents' Meeting

6:00 p.m.—*Hancock Room*
Order of Past Presidents' Dinner

9:00 p.m.—*Imperial Ballroom*
MFSA Ball (Admittance by A.E.S. or N.A.M.F. Registration Badge)

Tuesday, June 20

8:00 a.m.—*Room 418*
Charles Henry Proctor Memorial Leadership Award Selection Committee Breakfast

8:00 a.m.—*Parlor C*
Speakers' Breakfast

9:00 a.m.-5:30 p.m.—*Mezzanine*
Registration

9:00 a.m.—*Grand Ballroom*
Educational Session C

9:00 a.m.—*Room 436*
Membership Committee Meeting

9:00 a.m.—*Room 438*
Public Relations Committee Meeting

9:00 a.m.—*Room 437*
Publications Committee Meeting

9:00 a.m.—*Room 440*
Educational Committee Meeting

9:00 a.m.—*Bus from Statler Hotel*
Plant Visit, Gillette Safety Razor Co. (1st Group)

9:30 a.m.—*Bus from Statler Hotel*
Children's Tour

9:30 a.m.—*Bus from Statler Hotel*
Ladies' Tour

12:00 noon—*Parlor A*
Joint Educational Committee and Branch Librarians' Luncheon

12:00 noon—*Parlor C*
Speakers' Luncheon

1:00 p.m.—*Bus from Statler Hotel*
Plant Visit, Gillette Safety Razor Co. (2nd Group)

2:00 p.m.—*Grand Ballroom*
Educational Session D

2:00 p.m.—*Room 434*
Midwest Regional Council Meeting

2:00 p.m.—*Room 436*
Southwestern Regional Council Meeting

4:00 p.m.—*Room 442*
Regional Group and Council Chairmen's Meeting

4:30 p.m.—*Grand Ballroom*
Finishing of Light Metals Forum

8:30 p.m.—*Boston Symphony Hall*
Boston Pops Concert

Wednesday, June 21

8:00 a.m.—*Parlor A*
Research Committee Breakfast

8:00 a.m.—*Parlor B*
Speakers' Breakfast

8:30 a.m.—*Marshfield Country Club*
MFSA Golf Tournament

9:00 a.m.-12:00 noon—*Mezzanine*
Registration

9:00 a.m.—*Grand Ballroom*
Educational Session E

9:00 a.m.—*Georgian Room*
Educational Session F

9:00 a.m.—*Parlor C*
Research Committee Meeting

12:00 noon—*Parlor B*
Speakers' Luncheon

1:30 p.m.—*Bus from Statler Hotel*
Outing and Clambake

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Convention Committee



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Thursday, June 22

8:00 a.m.—*Hancock Room*
Speakers' Breakfast

9:00 a.m.—*Parlors A, B, C*
Supreme Society Business Meeting

9:00 a.m.—*Grand Ballroom*
Educational Session G

9:00 a.m.—*Georgian Room*
Educational Session H

9:00 a.m.—*Bus from Statler Hotel*
Plant Visits, Western Electric Co. and Raytheon Mfg. Co.

9:30 a.m.—*Bus from Statler Hotel*
Ladies' Tour

9:30 a.m.—*Bus from Statler Hotel*
Children's Boat Ride and Tour

12:00 noon—*Hancock Room*
Speakers' Luncheon

12:30 p.m.—*John Hancock Bldg.*
Ladies' Luncheon

2:00 p.m.—*Grand Ballroom*
Educational Session I

2:00 p.m.—*Parlors A, B, C*
Supreme Society Business Meeting

6:00 p.m.—*Georgian Room*
MFSA Cocktail Party

7:00 p.m.—*Grand Ballroom*
Annual Banquet

Friday, June 23

8:00 a.m.—*Parlor C*
President's Breakfast for National Officers and Families

9:00 a.m.—*Headquarters Room*
Executive Board Meeting



Joseph Sullivan
Outing



Edmund S. Jevely
Plant Visits



John A. Swift
Publicity



James H. Anderson
Registration



George E. Landis
Transportation

Technical Program

Monday, June 19

2:00 p.m.—Grand Ballroom

Third Annual "William Blum Lecture"

Chairman: *Dr. William Blum*

The Challenge Before Us, *Dr. C. L. Faust*, Battelle Memorial Institute.

Session A

Chairman: *James D. Thomas*
General Motors Corp.

1. The AES Research Program, *Dr. D. G. Foulke*, Sel-Rex Corp.
2. Progress Report on the Development of Corrosion Tests for the Performance of Plated Coatings, *W. L. Pinner*, McGean Chemical Co.
3. A Microscopic Study of Chromium Plating. *M. H. Jones and J. Saiddington*, Ontario Research Foundation.

2:30 p.m.—Georgian Room

Session B

Chairman: *Manson Glover*
Glover Coating Co., Inc.

1. Functional Vinyls Go Decorative, *F. L. Scott* and *H. Metz*, Metal & Thermit Corp.
2. Experience-Proven Epoxy-Acrylic Finish System, *R. F. Howard*, Bell Helicopter Co.

Tuesday, June 20

9:00 a.m.—Grand Ballroom

Session C

Chairman: *Dr. G. H. Kissin*
Kaiser Aluminum & Chemical Corp.

1. Nickel-Chromium Plating Upon Anodized Aluminum, *H. J. Wittrock*, Kaiser Aluminum & Chemical Corp.
2. Conversion Coating of Aluminum Alloys, *J. F. Murphy*, Metallurgical Laboratories, Olin Mathieson Chemical Corp.
3. Outdoor Exposure of Anodic Coatings on Aluminum: Effect of Sealing, *R. C. Spooner*, Aluminium Laboratories Ltd.
4. Effect of Voltage During Anodizing of Aluminum, *W. C. Cochran and F. Keller*, Alcoa Research Laboratories, Aluminum Co. of America.

2:00 p.m.—Grand Ballroom

Session D

Chairman: *Charles Levy*
Gillette Safety Razor Co.

1. Plating on Magnesium by Electrodeposition and Chemical Reduction Methods, *H. K. DeLong*, Technical Service & Development Lab., Dow Metal Products Co., Div. of Dow Chemical Co.
2. Anodic Treatments for Magnesium, *J. S. Kirkpatrick*, Brooks and Perkins, Inc.
3. Chromic Acid Anodizing of Beryllium: Process Parameters, *L. Whitby, E. Gowen* and *D. J. Levy*, Missiles and Space Div., Lockheed Aircraft Corp.
4. Chromic Acid Anodizing of Beryllium: Process Development, *L. Missel*, Missiles and Space Div., Lockheed Aircraft Corp.

Wednesday, June 21

9:00 a.m.—Grand Ballroom

Session E

Chairman: *Dr. George P. Swift*
Consultant

1. Quality Control Study to Determine Optimum Conditions for Barrel Plating in Zinc Cyanide Solutions, *Dr. R. E. Harr*, Western Electric Co.
2. The Practical Application of Statistics to the Quality Control of Electroplated Products, *J. J. Glass* and *J. K. Gore*, Los Alamos Scientific Laboratory.
3. Objectives in Corrosion Protection of Bright Decorative Trim and Their Implementation, *J. McDougall*, Ford Motor Co.

9:00 a.m.—Georgian Room

Session F

Chairman: *Hubert H. Foley*
Raytheon Manufacturing Co.

1. The Anodic Behavior of Metals in Cleaning Media — Copper and Its Alloys, *S. S. Frey*, Oakite Products, Inc.



George Marotta
Technical Co-Chairman

2. Improved Adhesion of Electroless Nickel Plate on Titanium Alloys, *M. Levy* and *J. B. Romolo*, Watertown Arsenal Laboratories.

Thursday, June 22

9:00 a.m.—Grand Ballroom

Session G

Chairman: *William P. Innes*
MacDermid, Inc.

1. Precious Metal Plating and Solderability, *A. Korbelak* and *R. Duva*, Sel-Rex Corp.
2. Vapor Deposition of Aluminum by Thermal Decomposition, *E. H. Maus, Sr.*, Queen City Steel Treating Co.
3. Stoichiometry of Copper Bonding Using Copper Oxide, *E. B. Murphy* and *T. P. Turnbull*, Massachusetts Institute of Technology.

9:00 a.m.—Georgian Room

Session H

Chairman: *Dr. M. M. Beckwith*

1. Corrosion-Current Data for Nickel-Chromium Couples, *W. H. Safranek, H. R. Miller* and *R. W. Hardy*, Battelle Memorial Institute.
2. Electroplating of Zinc-Base Die Castings in a System Incorporating Dual Chromium, *J. H. Lindsay, W. E. Lovell*, Ternstedt Div., General Motors Corp., and *D. W. Hardesty*, General Motors Corp. Research Laboratories.

2:00 p.m.—Grand Ballroom

Session I

Chairman: *Dr. Harold Narcus*
Electrochemical Industries, Inc.

1. Plating of Printed Circuits with Pyrophosphate Copper and Tin-Nickel, *R. W. Couch* and *R. G. Bikales*, Metal & Thermit Corp.
2. Evaluation of Solderability of Electroplated Coatings, *L. K. Bjelland* and *J. M. Thompson*, Convair-Pomona, Div. of General Dynamics Corp.
3. Producing Ultra-High Frequency Electronic Parts by Electroless Copper and Precious Metal Plating on Plastics, *C. E. MacNeill*, The Martin Co.

Abstracts of Papers

The Challenge Before Us

By Dr. C. L. Faust,
Battelle Memorial Institute

Research has been the key to progress in the processes used by members of and industries associated with the AES. Greatly improved performance can be attained by electroplates both as coatings and as electroforms. Efforts mainly have been process oriented. The time is here for greater emphasis on product orientation, on consideration of electroplates as materials, and on electrodepositing quality into electroplates instead of devising ways to inspect quality into them. The challenge is to take these steps by instituting the necessary actions.

The AES Research Program

By Dr. D. G. Foulke,
Sel-Rex Corp.

The origin and philosophy of the AES Research Program are discussed. Accomplishments in the past year are reviewed. Questions are raised as to the future of the AES Research Program and a plea is made for each AES member to acquaint himself with the program. Finally, recommendations are presented based upon the ever-increasing importance of research in a changing world where the only thing that does not change is change itself.

Progress Report on the Development of Corrosion Tests for the Performance of Plated Coatings

By W. L. Pinner,
McGean Chemical Co.

This report on AES Project 15 sets forth in detail the latest committee-approved procedures for conducting the CASS and Corrodkote Tests. The present status of the project is summarized and the future aims of the project committee are stated. The adaptability of the CASS and Corrodkote tests to finishing systems other than copper and/or nickel-chromium coatings on steel and zinc alloy basis metals is discussed. Information correlating the corrosion test results with service data is presented.

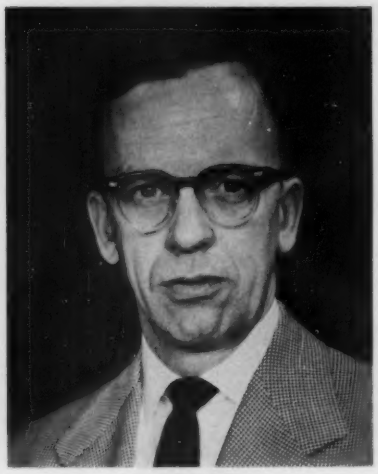
A Microscopic Study of Chromium Plating

By M. H. Jones and J. Saiddington,
Ontario Research Foundation

Project No. 14 describes an apparatus for the direct microscopic observation of the deposition of chromium on nickel and other basis metal surfaces. The study has provided information on the initial nucleation pattern, the development of cracking in chromium deposits and the associated hydrogen gas evolution for various plating conditions. The work constitutes an extension of the prelim-



Dr. William Blum



James D. Thomas



Dr. G. H. Kissin

inary investigation of Brittain and Smith and the microscopic observations are considered in relation to the mechanism of chromium deposition.

Functional Vinyls Go Decorative

By F. L. Scott and H. Metz,
Metal & Thermit Corp.

The spray application of vinyls as decorative finishes for consumer and industrial products is presented. The properties — corrosion resistance, toughness, resiliency — of plastisols already well know in their functional uses in the electroplating industry are maintained by the organosol technique used to produce attractive decorative finishes. Advantages of the spray-on organosols over the vinyl laminate and pre-coated vinyl sheet are outlined and demonstrated. Case histories on the use of spray-on organosols in the appliance, data processing equipment and automotive fields are covered in detail.

Experience-Proven Epoxy-Acrylic Finish System

By R. F. Howard,
Bell Helicopter Co.

A new finishing system in aircraft, automotive and related fields is presented. Two years of service experience have been completed with this finish system which utilizes the inherent properties of catalyzed epoxies and acrylics. This involves a paint finish setting at room temperature that combines the tenacious adhesion, chemical resistance, and toughness of epoxies, with the excellent resistance to outdoor weathering, diester oil resistance, and attractiveness of acrylics.

Nickel-Chromium Plating Upon Anodized Aluminum

By H. J. Wittrock,
Kaiser Aluminum & Chem. Corp.

Nickel-chromium plating upon anodized aluminum is a means of producing a bright corrosion-resistant finish. The method avoids the possibility of aggravated galvanic attack of the basis aluminum experienced when copper is part of the plated coating. The anodizing process for gaining nickel adhesion on various aluminum alloys is outlined and compared with other plating systems. Corrosion resistance in atmospheric and accelerated tests is comparable to that of similarly plated steel and is also benefited by plating techniques that enhance the integrity of the coating such as increasing plate thickness and plating with duplex nickel, crack-free chromium and duplex chromium.

Conversion Coating of Aluminum Alloys

By J. F. Murphy,
Metallurgical Laboratories,
Olin Mathieson Chem. Corp.

A review is made of the purposes of oxide, phosphate and chromate coating of aluminum alloys and the phenomena upon which their usefulness is based. There is a brief discussion of the physical and chemical properties of the coatings which are related to corrosion resistance and adhesion. Emphasis is placed upon the relationship between corrosion resistance and chemical composition. The adhesion of organic films to conversion coatings is analyzed in terms of composition and structure. Finally, there is a discussion of the probable mechanisms involved in the conversion coating process, in order to provide some reasonable hypotheses of the relationship between the mechanism of formation, the properties of the coating, and their effectiveness in improving corrosion resistance and adhesion of organic materials.

Outdoor Exposure of Anodic Coatings on Aluminum: Effect of Sealing

By R. C. Spooner,
Aluminium Laboratories Ltd.

The outdoor weathering behavior of sulfuric acid anodic coatings on aluminum alloys is discussed. Panels prepared by different procedures, including various anodizing conditions, a wide range of sealing treatments, and several overcoating techniques, were exposed outdoors in Canadian locations for periods up to 10 years. The nature of weathering attack is described for both bold and protected exposure conditions. Performance in laboratory tests and outdoor exposure is correlated with the various anodizing, sealing and coating procedures that were used.

Effect of Voltage During Anodizing of Aluminum

By W. C. Cochran and F. Keller,
Alcoa Research Laboratories,
Aluminum Co. of America

The voltage employed during anodic treatment of aluminum alloys plays a major part in establishing several important characteristics of the oxide coatings produced. Such features as brightness, specularity and abrasion resistance of the anodic finish can vary widely depending on the forming voltage. This factor is influenced by the presence of various alloying elements in commercial aluminum alloys. Data are presented showing how the anodizing voltage influences the appearance of an anodic coating. Anodizing procedures for obtaining bright, decorative finishes with optimum image clarity are discussed.

Plating on Magnesium by Electrodeposition and Chemical Reduction Methods

By H. K. DeLong,
Technical Service & Development Laboratory,
Dow Metal Products Co., Div. of Dow Chem. Co.

Recently there has been an increasing demand for plating on magnesium base alloys for electronic equipment in the aircraft and missile fields. Applications wherein combined good grounding, conductivity, solderability, and protection are a requisite are now being plated with final deposits of tin, nickel, silver, gold, platinum, etc. Also the increased use of these alloys in die cast form in the automotive field has prompted a demand for an effective and economical method of decorative chromium plating. Various methods of applying plated coatings to magnesium alloys are described along with some data on their relative corrosion performance in accelerated test environments. A new method is presented applying nickel on magnesium by chemical reduction.

Anodic Treatments for Magnesium

By J. S. Kirkpatrick,
Brooks and Perkins, Inc.

After a review of general finishing techniques for magnesium there will be an an-

alysis of typical corrosion behavior of magnesium alloys. The various protective anodic treatments which are applicable to commercial magnesium alloys will be described and the important process parameters will be outlined, together with their effect upon the physical and chemical properties of the coatings produced. The use of anodic coatings in typical commercial applications will be described.

Chromic Acid Anodizing of Beryllium: Process Variables

By L. Whitby, E. Gowen and D. J. Levy,
Lockheed Aircraft Corp.

Corrosion protective coatings are formed by anodizing beryllium in chromic acid, producing adherent, glossy-black coatings which are chiefly BeO. The films possess little porosity but have sufficient ionic permeability to permit growth. Film thickness is initially a linear function of current consumption but is independent of current density over a wide range. Film thickness also increases with chromic acid concentration up to 10 per cent, beyond which it remains constant.

Chromic Acid Anodizing of Beryllium: Process Development

By L. Missel,
Lockheed Aircraft Corp.

Practical methods of pre-anodic preparation and of chromic acid anodizing of beryllium are described. A jet-black, glossy coating with excellent protective properties was obtained. Basis metal quality and its effects on the anodic coating are discussed.

Quality Control Study to Determine Optimum Conditions for Barrel Plating in Zinc Cyanide Solutions

By Dr. R. E. Harr,
Western Electric Co.

Variations in the distributions of plating thickness caused by changes of barrel rotational speed, current density, and some effects of solution composition were studied by quality control techniques. Abbreviated form of process capability studies was used for this investigation.

The Practical Application of Statistics to the Quality Control of Electroplated Products

By J. J. Glass and J. K. Gore,
Los Alamos Scientific Laboratory

A practical use of statistics in quality control is described. A system is presented that offers a simple and economic way for inspectors to classify production lots. An actual use of the plans is related in detail and the calculations are described. Results of the use of this method as an inspection tool are shown graphically, and the usefulness of the system to the modern plater is demonstrated.

Objectives in Corrosion Protection of Bright Decorative Trim and Their Implementation

By J. McDougall,
Ford Motor Co.

The Ford Motor Co. was not satisfied with the quality of bright decorative automotive trim. The program that was effected to improve the durability of plated steel stampings and zinc die castings, anodized aluminum, and stainless steel parts is discussed. By an analysis of extensive data obtained by field surveys, mobile tests, and accelerated laboratory tests, the corrective action required to obtain improved durability was determined.

Corrosion-Current Data for Nickel-Chromium Couples

By W. H. Safranek, H. R. Miller and R. W. Hardy,
Battelle Memorial Institute

When nickel electroplate is coupled with chromium, a high current density and corrosion rate at the anode, usually nickel, are favored by a high electrolyte concentration, a high temperature, and a low nickel-to-chromium area ratio. The passivity of the chromium, which is dependent upon aging conditions, has a profound influence on the corrosion current. The information in this paper, based on research conducted for the American Zinc Institute, resolves some anomalies that obscured factors bearing on the corrosion of electroplated zinc die castings.

The Anodic Behavior of Metals in Cleaning Media — Copper and its Alloys

By S. S. Frey,
Oakite Products, Inc.

The anodic behavior of copper and brass specimens in several alkaline media is discussed. A new experimental procedure for making such studies is detailed. Parameters studied include current density, time and composition, concentration, and temperature of the solution. The specimens are subsequently plated with bright nickel, and evaluated with respect to appearance and adhesion.

Improved Adhesion of Electroless Nickel Plate on Titanium Alloys

By M. Levy and J. B. Romolo,
Watertown Arsenal Laboratories

Electroless nickel-phosphorus alloy plate was investigated as an anti-galling coating for titanium alloys. The alloy was deposited in a modified National Bureau of Standards alkaline bath. Adhesion and abrasion resistance were improved by heat treating at relatively high temperatures. Diffusion bonding with a minimum of beta transformation was detected by metallographic and X-ray diffraction studies. Resistance to wear and abrasion was correlated with structure, assessed metallographically.

Precious Metal Plating and Solderability

By A. Korbelak and R. Duva,
Sel-Rex Corp.

Various precious metal electrodeposits are discussed in conjunction with solderability as the last step in electronics manufacture. The effects of thickness, impurities in the deposits, and time-temperature conditions of various solders on solderability are given. Transistor, printed circuit, and relay manufacture utilizing specific precious metal electroplates are detailed.

Vapor Deposition of Aluminum by Thermal Decomposition

By E. H. Maus, Sr.,
Queen City Steel Treating Co.

Comparison of the thermal decomposition



William P. Innes



Dr. M. M. Beckwith



Dr. Harold Narcus

method versus the standard vacuum method, as well as engineering methods are discussed. A diagram of a typical facility is shown. Types of compounds for use in this method are presented. Deposition variables are given as are properties of coating-to-basis metal bonding.

Stoichiometry of Copper Bonding Using Copper Oxide

By E. B. Murphy and T. P. Turnbull,
Massachusetts Institute of Technology

A good physical bond and electrical connection can be achieved between a copper metal item and a film of copper chemically reduced from an aqueous solution by the use of a temporary oxide film. Data are reported on the physical properties of the bond and on oxidation reactions of copper. Electron diffraction patterns and micrographs of the oxides are presented. Chemical reaction products of each processing step have been observed and explored.

Electroplating of Zinc-Base Die Castings in a System Incorporating Dual Chromium

By J. H. Lindsay, W. E. Lovell,
Ternstedt Div., General Motors Corp.,
and D. W. Hardesty,
General Motors Corp. Research Laboratories

Zinc-base die castings for automobile body hardware have been electroplated on a large scale in a system involving the use of dual chromium. General plating practices are discussed. Problems arising from the use of dual chromium and the raising of performance standards are covered in some detail. Operation of the chromium baths is described, including discussion of factors involved in the maintenance of the micro-crack pattern. Corrosion resistance data are given.

Plating of Printed Circuits with Pyrophosphate Copper and Tin-Nickel

By R. W. Couch and R. G. Bikales,
Metal & Thermit Corp.

Printed circuits require electrical reliability, wear and corrosion resistance. The copper/tin-nickel system can be plated from standard production baths at lower cost and with improved quality over copper-gold. Pyrophosphate copper produces smooth, dense coatings on the surface and "through holes." The solution does not attack stop-off or laminated board. Tin-nickel offers corrosion resistance, low contact resistance, solderability and retention of solderability when used as a top coat. Its hardness improves wear.

Evaluation of Solderability of Electroplated Coatings

By L. K. Bjelland and J. M. Thompson,
Convair-Pomona, Div. of General Dynamics Corp.

Various electroplated coatings were evaluated to determine the effect of shelf life on their solderability by exposing plated terminals to a factory atmosphere for periods up to one year. A tensile test was developed whereby solder joints were evaluated quantitatively to determine the quality of the connections. Other tests conducted included solderability, corrosion resistance, resistance

(*Continued on page* 141)

Ladies' and Children's Programs



Mrs. George Swift
Ladies' Chairman



Mrs. George Marotta
Children's Chairman

The ladies' and children's programs will be under the able chairmanship of *Mrs. George P. Swift* and *Mrs. George Marotta*, respectively and their committees. Many interesting tours have been planned to keep the children entertained and the ladies well-informed while the men attend the technical sessions.

Sunday, June 18

3:00 p.m.—***Bay State Room***
Ladies — Boston Welcome Tea

8:00 p.m.—***Grand Ballroom***
Ladies and Children — Get-Together Party

Monday, June 19

9:30 a.m.—***Bus from Statler Hotel***
Children — Tour of Salem Marblehead Area, Including Luncheon

12:30 p.m.—***Ballroom Assembly***
Ladies — Luncheon Sponsored by The Udylite Corp.

9:00 p.m.—***Imperial Ballroom***
Ladies and Children — MFSA Ball (Admittance by AES or NAMF Registration Badge)

Tuesday, June 20

9:00 a.m.—***Bus from Statler Hotel***
Ladies — Tour of North Shore. Luncheon at Castle Hill, Crane Estate, Ipswich, Mass. Sponsored by M. E. Baker Co., The Lea Manufacturing Co. and Lea-Ronal Co.

9:30 a.m.—***Bus from Statler Hotel***
Children — Tour of Boston and Cambridge. Luncheon at Smith House

8:30 p.m.—***Boston Symphony Hall***
Ladies and Children — Boston Pops Concert

Wednesday, June 21

1:30 p.m.—***Bus from Statler Hotel***
Ladies and Children — Outing and Clambake at Historic Plymouth, Mass.

Thursday, June 22

9:30 a.m.—***Bus from Statler Hotel***
Ladies — Tour of Historic Boston

9:30 a.m.—***Bus from Statler Hotel***
Children — Boat ride on the Charles River. Tour of Museum of Science and Planetarium

12:30 p.m.—***John Hancock Building***
Ladies — Luncheon in Dorothy Quincy Suite, Sponsored by Sel-Rex Corp. Followed by Talk, "Gold and Man," Illustrated with Oil Paintings

6:00 p.m.—***Georgian Room***
Ladies — Cocktail Party Sponsored by MFSA

7:00 p.m.—***Grand Ballroom***
Ladies and Children — Annual Banquet

Friday, June 23

8:00 a.m.—***Parlor C, Statler Hotel***
Ladies and Children—President's Breakfast for National Officers and Families



Crane Castle

Metal Finishing Suppliers' Association

Program



F. P. Green
President



J. G. Carrique
1st Vice-Pres.



H. L. Kellner
2nd Vice-Pres.



R. M. Norton
3rd Vice-Pres.



R. F. Ledford
Past President



E. A. Blount
Exec. Secretary



J. E. Trumbour
Treasurer

THE functions of the Metal Finishing Suppliers' Association at the Boston convention will get under way on Sunday, June 18th with the trustees' meeting to be held at 1:00 p.m. in Room 409 at the Statler-Hilton, convention headquarters hotel, with *Fred Green*, president, presiding. All reservations for the various functions sponsored by the association have been made, and at this meeting ballots will be counted for election of trustees, the chairmen of various committees will make reports of projects undertaken during the year, and other matters will be discussed.

The MFSA annual luncheon and business meeting will be held at noon on Monday, June 19th in the Bay State Room. This affair is open to representatives of suppliers in the industry and has always been very interesting to those in attendance, as new officers are installed and many items of interest are discussed.

As in the past, the first of the social events sponsored by this organization will be the MFSA Ball, which will also take place on Monday, at 9:00 p.m. in the Imperial Ballroom. There will be continuous dancing and light beverages will be served. Admission to this event is by registration badge and, since the National Association of Metal Finishers is meeting in the same hotel, both AES and NAMF badges will be honored for admittance.

Although the golf tournament customarily takes place on Tuesday, this year it will be held on Wednesday, June 21st, beginning at 8:30 a.m., in order that the golfers may proceed to the outing and clambake, which starts at 1:00 p.m. at Plymouth, Mass. *Bob Burford*, golf chairman, and his associate, *Harry Sanders*, will be in charge of the tournament, at Marshfield Country Club, Marshfield, Mass. Greens' fees are $4.00.

A new social activity sponsored by the MFSA at the Los Angeles convention last year was the MFSA cocktail party just prior to the annual banquet on Thursday evening. It was so well received, that the association has decided to hold the cocktail party again this year. It is scheduled for Thursday, June 23rd, from 6:00 to 7:00 p.m. in the Georgian Room, Parlors A, B, and C.

A word of thanks is due to *Manson Glover*, who has done a fine job in acting as liaison representative between the MFSA and the Boston convention committee.



J. A. Cairns
Trustee



E. L. Combs
Trustee



K. Ruhly
Trustee



R. C. Trees
Trustee



J. M. Davidson
Trustee



H. J. McCracken
Trustee



M. Glover
Liaison



R. M. Burford
Golf Chairman

NAMF To Meet In Boston



Napoleon A. Vigeant
Chairman



Mrs. Napoleon Vigeant
Ladies' Chairman

The National Association of Metal Finishers will hold its annual convention prior to the American Electroplaters' Society convention. The NAMF will also use the Statler-Hilton Hotel as headquarters for its meetings, which start on Friday, June 16th.

Program

Thursday, June 15

6:00 p.m.—*Hospitality Room*
Get Acquainted Party

Friday, June 16

8:30 a.m.-4:00 p.m.—*Mezzanine*
Registration

9:30 a.m.—*Parlor A*
Annual Meeting and Election of Directors

1:30 p.m.—*Parlor B*
Board of Directors' Meeting and Election of Officers (Executive Committee)

3:00 p.m.—*Veranda Room*
Ladies Tea and Style Show

6:00 p.m.—*Parlors D-E*
Dinner-Meeting: Association Executives of Affiliated Groups

Saturday, June 17

9:00 a.m.-5:30 p.m.—*Mezzanine*
Registration

9:00 a.m.—*NAMF Desk*
Historic Tour for Ladies and Children

10:00 a.m.—*Ballroom Annex*
1st Management Seminar: Speaker — John S. Morgan, Steel Magazine, "What's Ahead for Depreciation"

1:00 p.m.—*Ballroom Annex*
2nd Management Seminar: Speaker — William P. Mallory, U. S. Leasing Corp, "Is Leasing Profitable?"

2:45 p.m.—*Ballroom Annex*
3rd Management Seminar: Speaker — Dr. Malcolm F. Severance, Univ. of Vermont, "Labor Relations: Perspective-Prospective"

7:00 p.m.—*Bay State Room*
Reception and Cocktail Party

8:00 p.m.—*Bay State Room*
Banquet, Awards Presentations

Sunday, June 18

9:00 a.m.—*Portsmouth, N. H.*
Golf Tournament

1:00 p.m.—*Portsmouth, N. H.*
Clambake and Outing

Monday, June 19

8:30 a.m.—*NAMF Desk*
Ladies and Children — Cruise to Provincetown in Cape Cod

9:00 a.m.—*NAMF Desk*
Plant Tours of Reliable Silver Inc. in Somerville, Consolidated Metal Corp. in Cambridge, F. M. Callahan & Son in Malden, and M & V Electroplating Corp. in Newburyport



Robert L. Giesel
President



Frank Kaiser
Secretary-Treasurer



P. Peter Kovatis
Executive Director

Aluminum Finishing Progress

By Norman I. Gaynes, *Technical Director, Titanine, Inc., Union, N. J.*

IN recent years the uses of aluminum have been increased hundred folds. For the aircraft industry its light weight and relatively high corrosion resistance has made this white metal an essential material of construction. The automotive industry, however, has only really begun to dent the surface in potential uses of aluminum. From an average of only about 53 pounds per car used in 1958 it is expected to grow to an average exceeding 300 pounds within the next 5 years. The advent of the era of the compact car may accelerate this rate of growth even further and the total overall average use per car may surpass even the most optimistic forecasts.

The engineering department of one of the automobile manufacturers recently discovered that it was cheaper to use aluminum in the cowl panels of the interior than the cardboard which was used heretofore. Of course this, on the surface, appeared fantastic but, while the cost of the cardboard was less than aluminum, it cost some 25 or 30 cents per car to fasten the cardboard, as against only about 10 cents for the aluminum. Thus, it can be realized that aluminum was cheaper and, from a quality standpoint, far superior.

These new uses for aluminum, of which this cowl panel was only one of many, has brought to the fore the question of more and improved finishes for aluminum. For many years, and indeed as of now, anodic oxidation or anodizing is still the prime standard used for comparison with other finishes for evaluation of durability and corrosion resistance. Admittedly, anodizing does contribute considerably to the finishing of aluminum but, as with everything else in this world, it is not perfect and new, improved supplements to finishing must be developed and utilized.

Anodizing is relatively expensive and, when the cost of anodized aluminum is compared with copper-nickel-chromium on steel, the use of aluminum may not be favored. In addition, another drawback to anodizing has been the restriction to certain alloys which, in automotive are 5457, 5557, and 5657. For high strength, the 6063 heat-treatable alloy has been precluded because it cannot be bright-anodized. The corrosion factors of bright-anodizing will be discussed further on. Suffice it to say, however, that the 10 to 30 cents per square foot (depending on size and shape of the part) cost of anodizing prohibits the use of aluminum in many potential areas.

Aluminum die-castings for such items as mirror brackets, door handles, etc., have not been used extensively, mainly because the die-casting alloys, while usually stronger than their zinc type counterpart, cannot be bright anodized or chromium plated on an inexpensive practical basis.

The need then for newer and varied types of finishes has been established sufficiently for the many areas where anodic oxidation cannot practically be performed, or where the cost factor is a restrictive item. Organic finishes as protective coatings on aluminum have always had innumerable drawbacks and, as such, never offered the required suitable supplements. As technology has progressed in other fields, so too has research and development advanced in both the raw material phases, and lacquer and enamel formulation areas. The studies of cross-linking, that is, the combination within the chemical molecular chain of various resins and compounds, have produced organic coatings of "plastic" strength and durability, so that it is now possible to offer supplements or substitutes for anodizing.

Evaluation Tests

To better understand the requirements for use on an automobile, one could best look at the typical accelerated evaluation test which most companies utilize. Salt fog is, of course, still an old standby. The merits of this particular test have long been argued, particularly as to its lack of correlation with actual exterior exposure, but it must be understood also that many automobiles are sold in the shore areas where salt air is highly prevalent. Further it should be pointed out that, in a goodly number of cities, snow removal is facilitated with rock salt or calcium chloride, which eventually lands on portions of the protective coatings of the automobile. For these reasons the salt spray test is still valid, even if only to give an indication of the chemical resistance properties of the film being tested. Most of the laboratories require 250 hours in the 5% neutral test inclined at 15° to the vertical (ASTM Method B117-57T). Some incline at 45° which is far more corrosive. The test also deviates from the standard in that the edges are not sealed with wax. No edge creepage is allowed on the theory that automobile parts will not have a wax seal on the edges.

Nearly all evaluations include an immersion in circulating distilled water at room temperature. At 250 hours no corrosion, discoloration, or other film defect should be noted. This is carried still further in some plants with a 100% humidity test for periods up to 1,000 hours.

The accelerated tests, such as the copper chloride modified acetic acid salt spray (Cass test) and Corrodkote tests developed in conjunction with AES research projects, are also used widely. These consist, in Cass, of addition of one gram copper chloride ($CuCl_2 \cdot 2H_2O$) per gallon of acetic acid salt spray solution, and Corrodkote, which employs the application to the test panel of a paste consisting of ferric chloride, cupric nitrate, ammonium chloride, kaolin, and distilled water, and placed in a 100% humidity cabinet. Both tests formerly required 16-20 hours exposure but, with the advent of multiple nickel and duplex chromium as competitors, numerous cycles may be required in either Cass or Corrodkote.

Tests which can be linked together under one grouping, are flexibility, adhesion, and impact resistance. At various times many of these tests overlap. For example, one can consider the bend test with either a conical or the individual specific mandrel diameter sizes. In either case let it be assumed that a failure or cracking is observed. Snap judgment would immediately class this failure as one of flexibility yet, on many occasions, modification of a formulation with an embrittling type material such as a hard maleic resin which improves adhesion, has been found to correct bend test failures. Thus, when one tests flexibility, adhesion, or impact resistance, it is in nearly all cases impossible to decide whether, on the finer points, it is any particular one of the three which causes failure.

The most common flexibility test, as mentioned, is the bend test. There are, of course, other tests such as the per cent elongation method as a variation of the bend test method, wherein a conical mandrel is used to determine the smallest diameter where no cracks occur. Then by use of the formula:

$$\text{Per cent Elongation} = 100 \times \frac{t}{d + t}$$

Where t = thickness of panel

d = diameter of mandrel

a value is obtained. However, a correction to this calculated value must be considered if a standard measurement or comparison value is to prove valid. Thus, one must consider the correction based on the film thickness of the coating itself. The table below is the correction factor each mil of film:

Diameter of Mandrel

1 inch	*¾ inch*	*½ inch*	*⅜ inch*	*¼ inch*	*⅛ inch*
0.21	0.26	0.38	0.50	0.73	1.37

Usually, in reporting this test, three samples of different thicknesses are utilized and the average elongation used as the result.

Cold cracking, or the affect of sudden temperature changes, is still another method of determining flexibility, as are the many instruments which in one manner or another determine the same properties.

Adhesion and impact resistance are determined by one company after a period of Florida exposure. In one case a gravelometer is used, which impinges small stones or shot against the panel to determine the amount of flaking caused by the gravel action. In another instance, the common cross-hatch test is used, wherein a narrow checkerboard pattern of 100 - $\frac{1}{16}$" squares are cut into the film with a sharp knife and the knife, held at right angles to the film, is then rubbed across the cross-hatch area, with flake-off noted. Still another variation of this same method is substitution of an adhesive or masking tape, which is pressed onto the cross-hatch area and removed quickly with even, rapid pull. Here, again, flake-off is noted.

Impact is sometimes simply evaluated by using a standard weight or steel ball whose weight is known, and dropping it through a standard distance onto the panel either directly on the film or on the uncoated side to determine reverse impact.

It is not meant to bore the reader with too many details of tests with which he may be completely familiar, but certainly an explanation of some of the tests is a prerequisite, if one is to realize the difficulties encountered in attempting to produce organic finishes on bright automotive type aluminum as an alternative to anodizing, whether it be for reduced costs, practicability, or increased durability.

Anodizing Specifications

Before proceeding any further it may be well at this point to discuss the broad term "anodizing" so that a means of comparison of like terms is afforded and not an illustration of "apples vs. pears." For this reason a common base of reference could well be government specification MIL-A-8625A, "Anodic Coatings, for Aluminum and Aluminum Alloys," since quite often in the discussion of anodizing this particular specification is quoted. Within its scope there are two types. Type I are chromic acid coatings and Type II comprise sulfuric acid anodic films. It recognizes that Type I films are far more corrosion-resistant than those oxide films deposited from the sulfuric acid bath. Actually, three times the weight of Type II is required, to be the equivalent of Type I films. However, since the requirements for an automotive or similar application is usually for the brightly buffed chromium-like appearance, it precludes the use of the chromic acid bath. Chromic acid films for most alloys are of the reddish-brown or iridescent type. For decorative finishes this is completely objectionable. The only alternative then, for purposes of comparison here, is to consider the Type II film. The specification of reference requires a minimum of 600 milligrams of oxide film per square foot. Automotive requirements on the other hand require approximately 12 milligrams per square *inch* or 1728 milligrams per square foot. This usually converts to an average film thickness of 0.3 mil.

It is imperative at this point also to distinguish between the requirements of specification MIL-A-8625A and that usually utilized for automotive evaluations. The testing specification, Federal Standard 151, referred to in MIL-A-8625A, permits either 5% or 20% salt spray. In most industries, such as aircraft, etc., and the government itself, the 20% test is still the most used. Automotive requirements almost always use the salt spray (ASTM B-117-57T 5%). Surprising as it may seem on the surface, the 5% salt spray is far more corrosive than the 20% method. Therefore, in the discussion here, all references to salt spray will be in terms of the 5% concentration and all refer-

ences to anodizing will be to the sulfuric acid process.

The weight of film per unit area is also one of the most important considerations, if the water sealing operation has been conducted at 208°F. or higher. The concept of sealing temperature has always been shown to be critical, but a new test recently developed for automotive evaluation of anodizing called the F.A.C.T. test has shown a direct correlation between sealing temperature and corrosion resistance. This particular test, details of which have been publicly announced only recently, is an electrolytic version of Cass in that the copper-modified, acetic salt solution is used as the electrolyte. Since corrosion in itself is an electrochemical reaction, it was felt in developing this new procedure, therefore, that an electrochemical method would provide the best correlation to actual field conditions. In addition, a short practical quantitative test wherein results could be obtained in minutes rather than hours, was felt to be of utmost importance.

Basically the F.A.C.T. test is based on the application of an electric current on the surface of the sample, and the electrical resistance of the surface measures the corrosion-protection value of the anodic film. Since the electrolyte is corrosive, this also has the effect of obtaining reproducible results in a shortened period. In the case of the F.A.C.T. test only three minutes are required to produce a recorded graphical answer to the protective value of the coating being tested.

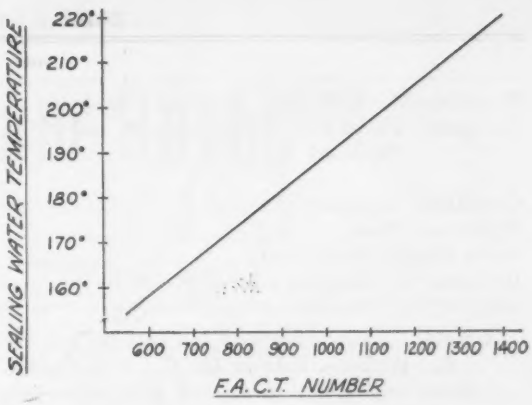
In essence, a current of 0.8 milliampere is placed across the oxide coating and the voltage required to force the current through the film is measured. It can also be called a measure of resistance. In a highly resistant coating a high voltage is required, while, in a coating with lesser protective value, a lower voltage reading will be obtained. For a more meaningful rating which is easily duplicated, the developers of this new test have converted the instantaneous voltage to frequency and use a frequency counter. By this combination, the integration of the area under the voltage-time curve is accomplished and includes the product of the resistance and time. The resultant number is then called the F.A.C.T. number.

Returning then to the question of sealing water temperature, the accompanying diagram of temperature versus F.A.C.T. number shows the definite increase as the temperature rises, and is valid irrespective of the weight per unit area of the anodic film or the film thickness. It should be pointed out also that F.A.C.T. values of 600 are obtained on unsealed anodized films and that only an insignificant increase is obtained at sealing temperature of 160°F.

Returning then to the method of control for anodic films as put forth in specification MIL-A-8625A and other commercial specifications, it must be noted that the minimum weight of milligrams per square foot is only valid if the sealing operation has been performed at 208°F.-212°F., as required by the aforementioned specification.

Organic Finishes

It becomes increasingly apparent that the need for aluminum finishes is a constant, evergrowing essential. As has been pointed out, anodic oxidation is important and valuable, but limited in many respects. Many alloys cannot be bright-anodized, and the procedure itself has many complications. To supplement the requirements for aluminum protection, it is desirable that finishing eyes be turned toward the organic branch for improved aluminum films.



Organic, clear films have always had many disadvantages. Adhesion to aluminum and aluminum alloys has always been difficult, particularly where cleaning methods were deficient. These clear films also failed by checking, peeling, yellowing, etc., and, as a result, many specification engineers lost complete confidence in this phase of finishing aluminum. Within the last year or two, evidence has been mounting that developments and improvements in raw materials for paint films has again rekindled the outlook for organic coatings for aluminum.

Regardless of what finishing is used, whether it be chromium plating on steel, anodizing, or paint application, cleaning and preparation of the basis metal is still the most critical factor to be considered. It is true that in many plants this phase is glossed over and seemingly satisfactory finishing obtained, but only where the ultimate in testing and requirements are needed, do they appear appreciably substandard.

The same holds true for clear, organic coatings applied over buffed bright aluminum. Many times in the past, when this type finishing was utilized, it was the standard practice merely to vapor degrease and then coat. If the material applied produced a hard film it appeared satisfactory, but on exterior exposure usually turned cloudy, developed checks, or just plain peeling. Actually, from a theoretical standpoint, this could have been anticipated. The vapor degreaser removed the grease binder but left an alkaline surface from the lime compounds used in the buffing operation. An organic film applied over this surface usually deteriorated because of the reaction between the alkali and the resinous components of the coating. The reaction produced a form of soap which destroyed the adhesion and permitted moisture to penetrate.

In a recent evaluation to point up the critical requirements of surface preparation, buffed aluminum panels were prepared as follows:

TABLE I

	Organic	*Anodic*
Humidity: At 120°F.-100% humidity, 1000 hours	No failure	Considerable white corrosion
Salt Spray: 5% at 95% relative humidity and 95°F., 250 hours	No failure	Considerable white corrosion 72 hours
Corrodkote: 20 hours	No failure	Considerable corrosion 8 hours
Reflectance: Loss	No appreciable loss	20% loss
Sulfur Dioxide Atmosphere	No failure 200 hours	Considerable corrosion 50 hours
Detergent: 1% detergent solution @ 170°F.	No failure 200 hours	Considerable corrosion 50 hours

A Series — Vapor degrease and coat 0.3 mil dry film thickness. Bake at 350°F. for 20 minutes.

B Series — Vapor degrease and soak in non-etch aluminum cleaner. Coat with 0.3 mil dry film thickness. Bake at 350°F. for 20 minutes.

C Series — Vapor degrease, soak in non-etch aluminum cleaner and dilute acid dip. Coat with 0.3 mil dry film thickness. Bake at 350°F. for 20 minutes.

All panels were subjected to 20 hours in the Cass test. At the end of the test cycle, examination of the panels showed definite failure over the whole portion for the A series, lesser failure on the B series, and no failure at all on any portion of the C series panels. Thus, since the coating was the same in all cases, failure could be attributed only to improper substrate preparation.

There are many organic coating materials which can be used, provided, of course, that good surface preparation practices are followed. In comparatively recent times, new alkyds, vinyls, acrylics, epoxies, etc., have been developed. Many of these materials have excellent properties but, unfortunately, also have deficiencies. Therefore, when one considers epoxies for bright finishing, its disadvantages of chalking and yellowing must be considered. In the case of acrylics the brittleness and lack of adhesion are important factors. Alkyds may be too soft, and vinyls may check in sunlight. All these problems must be considered by the formulator. However, much work has been accomplished in modification of the basic resins so that, today, many superior organic clear coatings for aluminum are in evidence throughout the industry.

One particular coating has made its appearance wherein two supposedly incompatible resins have been brought together with a third catalytic type agent in a chemical cross-linking reaction. The by-product of this reaction combined with the basis metal to provide a fully integrated inorganic surface while, at the same time, also providing a clear, organic, protective film with excellent chemical resistance. The action here is very similar to the familiar WP-1 wash primer effect.

Another item of importance necessary to overcome the prejudices of organic coatings must also be explained. For a long time it was felt in many quarters that bright, highly-polished, reflective surfaces would deteriorate more rapidly than unpolished surfaces because destructive ultra-violet light would pass through the film twice, that is, once to the basis metal and then reflected back out. Fortunately, accelerated Fadeometer tests and actual exterior Florida exposures do not bear out this contention. The theory here would seem to be that it is not the ultra-violet light as such which causes the destruction but, rather, the conversion of the short ultra-violet wavelengths to another form of energy which causes the destructive effects. In actuality, this could be compared with electricity which in itself does nothing but, on conversion to heat and power energy, gives us the lights and motors which are our everyday source of living luxury. Thus, if we return to the thin organic film on a bright surface, the ultra-violet has little or no time to convert to energy in its quick transit through the film. This postulation is further corroborated when it is noted that heavier film thicknesses tend to deteriorate faster than thin films, particularly on those coatings whose inherent characteristics are those of yellowing and chalking.

All told then, it can be easily seen that organic finishing materials are needed and can become an excellent supplement where, in the overall picture, anodizing is restrictive. Clear, synthetic films would offer the following advantages:

1. Reduced cost and application
2. Less expensive alloys could be protected
3. Non-anodizable alloys could be used and protected
4. Improved corrosion resistance in many cases
5. No loss of reflectivity

In reference to number 4 above it must be emphasized again that only films of approximately 0.3 mil are being compared, that is, both properly sealed sulphuric anodizing and organic coating. Heavier films of properly sealed, anodic films would give increased corrosion protection, but the loss of reflectivity precludes its practical application here.

In considering the increase in corrosion protection offered by organic films, it is best to equate results based on accelerated testing for startling comparison figures. Since anodized films on automotive trim have failed in relatively short periods of exterior exposure, particularly in areas where salt and calcium chloride are frequently used for snow removal, the case for these accelerated tests is validated. Again emphasis is made on the 0.3 mil maximum anodic film used in automotive, and not the heavier architectural or chromic acid coating. Table I gives a brief summary of accelerated results obtained.

The case for organic finishing of aluminum is shown to be meritoriously established. Certainly it is worthy of further consideration. Of course, even with accelerated test advantages, it is not the panacea for

(*Continued on page* 80)

Analysis of Rhodium Baths

Volumetric Metal Determination

By Harold G. Rackett

THE rhodium content of rhodium plating solutions usually has been determined gravimetrically. Thus, determinations could only be made in laboratories that have an analytical balance. A volumetric method was developed, which eliminates the need of a balance. Almost all analytical methods, both gravimetric and volumetric, require some manipulative skill. The volumetric method that will be described is certainly no exception, but it does make possible the determination of rhodium in any laboratory that contains the most limited amount of apparatus. It is *not* an assay method but, in 2.0 g./l. rhodium solutions, results were obtained that consistently agreed, within 3%, with those obtained gravimetrically.

Volumetric methods can be divided into two classes: those based upon the combination of ions (acidimetric, alkalimetric, precipitation, and complex ion reactions) and those based upon the transfer of electrons (oxidation-reduction reactions). No reaction of rhodium could be found that could be made the basis of a method of the first class. But rhodium does form an oxide in which its valence is plus four instead of its normal valence of plus three. It is this oxide, rhodium peroxide, which is the basis of the oxidation-reduction method that will be described.

The procedure has been tried only with phosphate-type rhodium plating baths. But, there is no reason to suspect that the results would not be identical if the method were used with the sulfate-type. Nor, was the method tried with rhodium plating baths containing metallic impurities. The effects of impurities are discussed after the presentation of the analytical procedure.

When first using this method, it is recommended that duplicate analyses be run so that more faith can be placed in the results.

Analytical Procedure

Transfer a representative sample of the rhodium plating solution to a beaker, flask, or bottle. Pipette 25 ml. of this into a 250-ml. Griffin beaker of heat-resistant glass. Add 10 ml. of 200 g./l. sodium hydroxide solution. Stir and heat slowly to boiling over an electric hot-plate or a gas burner. The rhodium will be precipitated as yellow rhodium hydroxide, $Rh(OH)_3 \cdot H_2O$, either upon the addition of the sodium hydroxide or upon heating. Do *not* cool the solution. Add 20 ml. of a 2M sodium hypochlorite solution (ordinary household bleach may be used). Stir and boil the contents of the beaker until the original 55 ml. is reduced to approximately 30 ml. The yellow rhodium dioxide will be immediately oxidized to green-black rhodium peroxide, RhO_2, which is also insoluble. The further boiling rids the solution of almost all of the excess hypochlorite, evidently without the formation of any chlorate:

$$2OCl^- \xrightarrow{\Delta} O_2\uparrow + 2Cl^-$$

This heating and boiling need not be carried out in a hood. No toxic gases are expelled, but the solution is very caustic and care must be taken to avoid splashing it upon oneself.

Remove the beaker from the heater or burner and add approximately 100 ml. cold water to dilute and to cool the solution. Add approximately 5 grams (or 1 teaspoon, slightly heaping) of solid ammonium chloride. Stir to dissolve. Add approximately 10 ml. of 5 g./l. starch solution and approximately 2 grams (or ¼ teaspoon, slightly heaping) of solid potassium iodide. Stir to dissolve. Carefully pour in 20 ml. of 50% by volume hydrochloric acid while stirring the solution. The rhodium peroxide will oxidize the iodide to iodine, which will give a deep purple color with the starch indicator:

$$2RhO_2 + 2I^- + 8H^+ + 12Cl^- \rightarrow 2RhCl_6^{\equiv} + I_2 + 4H_2O$$

Titrate immediately, while stirring the solution, with standardized 0.05 N sodium thiosulfate solution to the absence of the purple iodine-starch coloration. The end-point is quite sharp; deep purple to pale yellow:

$$I_2 + 2S_2O_3^{=} \rightarrow 2I^- + S_4O_6^{=}$$

Calculation:

If the sodium thiosulfate solution is 0.05 N,

ml. $\times$ 0.206 = g./l. rhodium metal

If some other normality is used,

ml. $\times$ (4.12 $\times$ normality) = g./l. rhodium metal.

Discussion

Rhodium peroxide is very easily reduced and will revert to rhodium hydroxide merely on standing in the beaker. There should be no long delays once the analysis is begun. The titration should be performed

immediately after the addition of the hydrochloric acid if high results are to be avoided. Iodide in acid medium is slowly oxidized by the oxygen in the air:

$$4I^- + 4H^+ + O_2 \rightarrow 2I_2 + 2H_2O$$

If the contents of the beaker are allowed to stand after the titration, the purple color will return slowly, as the above reaction occurs. This is to be expected. However, the significant end-point is the *first* disappearance of the purple color.

The results are high if the potassium iodide is added *before* the ammonium chloride. Perhaps the ammonium chloride destroys any remaining hypochlorite that has not been decomposed by heating:

$$3OCl^- + 2NH_3 \rightarrow 3Cl^- + N_2 \uparrow + 3H_2O$$

If no ammonium chloride is added, the purple color returns rapidly after the end-point is reached. Only when ammonium chloride is added, is the end-point stabilized at all.

The thiosulfate solution should be added slowly so as not to overrun the end-point, drop-by-drop near the end. If back-titration is deemed needful, a standardized copper sulfate or iodine solution could be used. There is little advantage in postponing the addition of the starch solution until near the end of the titration.

Any metal that can be oxidized to a higher-valence, which will oxidize iodide to iodine in an acid solution, will interfere if present as an impurity in the plating bath, in the analysis as heretofore described. Such metals as iron, nickel, cobalt, copper, lead, and manganese would thus interfere. The results would not be a measure of rhodium alone but rather some sort of measure of the cumulative quantities of rhodium and any of these impurities. However, significant quantities of most of these base metals could not be tolerated in the rhodium plating bath, and also would be very unlikely to enter the bath. But, considerable iron might be tolerated, and it might have been added in a purification procedure for removal of other impurities. The following modification in the analytical procedure would probably eliminate the iron interference, but this has not been tried. Add approximately 4 grams (or 1 teaspoon, slightly heaping) of solid ammonium fluoride instead of ammonium chloride, before the addition of the potassium iodide. The fluoride ions would form a complex with the ferric ions liberated when the solution was acidified and, thus, prevent the oxidation of iodide by the ferric ions:

$$Fe^{+++} + 6F^- \rightarrow FeF_6^{---}$$
$$2Fe^{+++} + 2I^- \rightarrow 2Fe^{++} + I_2$$

The ammonium fluoride would also contribute a buffering action when the solution is acidified with the hydrochloric acid. The optimum pH after acidification is about 4.0. If the pH is very low, the purple color will return more rapidly after the end-point of the titration is reached.

Preparation of Reagents

Sodium thiosulfate solution (0.05N):

Dissolve in one liter of water 12.5 grams of $Na_2S_2O_3 \cdot 5H_2O$, and add 0.1 gram of sodium carbonate to the solution. Keep this solution in an amber bottle.

This solution must be standardized against another solution whose strength is known accurately. A solution of potassium iodate, potassium bromate, potassium dichromate, or copper sulfate could be used. This standard must be purchased if no analytical balance is available for use in either its preparation or standardization. A standardized rhodium solution need not, and indeed should not, be used.

The sodium thiosulfate solution need not be 0.05 N but this strength causes a convenient quantity to be used in the titration. For a 2.0 g./l. rhodium solution, 9.7 ml. would be required. Standard thiosulfate solution is stocked by all laboratory supply houses.

Starch solution:

Make a suspension of 5 grams of soluble starch in a little water. Add the suspension slowly to one liter of boiling water. Continue boiling until the solution is clear. Add 0.1 gram of mercuric chloride (preservative). Cool the solution and transfer to a bottle.

Sodium hypochlorite (2M):

There is no simple way to prepare this solution. Ordinary household bleach can be used, or it may be purchased from a chemical supply company.

The preparation of the 200 g./l. sodium hydroxide solution and of the 50%-by-volume hydrochloric acid does not require description, except to say that it must be done with due caution. The term hydrochloric acid refers to the "concentrated" acid, approximately 12 N.

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ALUMINUM FINISHING PROGRESS

(*Continued from page* 78)

all corrosion problems. The main purpose here is to stimulate thought and attempt to overcome strong prejudice developed through the years.

Organic finishing is a practical method for protection of aluminum and aluminum alloy surfaces. However, it cannot be emphasized too strongly that proper preparation is necessary. Curing of organic films must be done according to the manufacturer's suggestions. Hedging on time schedules does not fool the manufacturer of the coating. Rather, it fools the finisher himself who thinks he is getting away with something. A true cure will give excellent results but a shortened cure may produce horrifying failure.

To summarize the study conducted, it has been shown that anodic films are, without a doubt, the accepted standard of aluminum protection. However, of necessity, it is restricted in many ways. Therefore, if the finishing industry is to diversify enough to meet the challenge of the ever growing fabricating use of aluminum, it would seem that improved organic finishes and finishing methods offer the supplement to meet that challenge.

Studebaker Finishing Developments

By Haviland F. Reves

A CAREFULLY balanced combination of automation with individually controlled operations characterizes new developments in finishing procedure in the Studebaker-Packard Corporation plant at South Bend, Indiana. Like all American automotive plants, this one deals with relatively large and complicated production units, turned out on a production basis. This condition in today's technological world leads apparently inevitably to automated controls of the various production functions as far as possible. But the special aspects of this company's operations dictate a significant reliance upon individual manual and mechanical functioning in many steps.

The result is an automotive finishing line which its operators believe to be one of the fastest in production in this, America's leading industry.

The plant is the oldest sizable plant used for production in the automotive industry today, and it has been necessary to do some experimentation and sound planning to adapt it to the requirements of modern automotive production — but it has been done. It was eight years ago that Studebaker celebrated its centennial — under the latest paint on one of the old four story buildings, one may still discern the historic legend, "Vehicles and Harness."

Considerable changes in production technique were made when Packard production was moved to South Bend about four years ago. This company is characteristically independent, being the only important car manufacturer in the country today without general headquarters in Detroit. Its position is that of a typical American manufacturer — an important manufacturer of a major national product, holding its own in a world of economic giants.

In the course of the past year, the company invested about $1,500,000 in new metal finishing equipment, creating an installation that utilizes automation where it can function economically, and an array of automatic and mechanical aids where flexible control is required. This has meant a complete revision of the basic body finishing operations in the plant, designed to achieve maximum efficiency and economy — for the size and variety of the company's output.

Most important from the standpoint of finishing problems is the variety of output. Eight different body styles are involved, which may include station wagons, two and four door units, convertibles, hardtops, cruisers, and the Hawk line. Color specifications may be different on each successive car coming through. The large volume car manufacturers can establish separate lines or sublines for the principal model and even color selections — but this is impossible on the Studebaker-Packard line. All finishing is done in a single line — which becomes dual for increased production purposes only in its critical later stages.



Exit side of one of the primer surfacer electrostatic spray booths.

Typical of the way this company has incorporated the new into the old is the installation of the new body finishing line essentially in its entirety on the second floor of Plant No. 1 — an old six-story building which is an apparent anomaly in an age that favors one-story plant layouts. But the concentration and relocation of finishing facilities, formerly spread over at least two floors, has released other areas of this building for efficient use in production and essential storage of bodies for production flow. All six floors are now used effectively in this connection. The location of the building half a mile from the final assembly operations has been met by an over-the-rooftops conveyor system.

Preparatory Work

An entirely new first floor installation prepares a large variety of sheet metal parts. Those treated in this phase are (a) parts requiring special protection against corrosion; and (b) parts that are difficult to paint or inaccessible after they have been incorporated in the body shell assembly, such as inside components of door panels. In general this includes lapover seams and other points to be welded.

Such parts are given a preliminary sanding. Imperfections in the white metal are disc-sanded or jitterbug-sanded out in the white metal. All necessary buffing and welding are performed here.

The parts are then placed on an overhead monorail

conveyor which takes them through a washing machine. This is two-stage washer, but unusual in that it combines two operations, simultaneously cleaning and phosphating. The parts require one minute to pass through, and receive a deposit of 50 mm per square foot of iron phosphate. Pump pressure is at a 75 foot head.

A cold water rinse follows. The material then enters a chromic acid rinse at 160°* for one-half minute. It then receives a bake in an infrared dry-off oven for approximately three minutes at about 250°. Air drying completes this phase as the material moves along.

The parts then move into a water-washed spray booth, where those portions which are to be concealed after assembly are covered with aluminum weld-through primer by means of a manually-operated airless spray. This preliminary process provides full corrosion protection for parts subsequently inaccessible.

The various sheet metal parts then move on to the proper assembly points, which are located on both the first and third floors. The body shell is assembled on the third floor and then lowered to the second for the finishing operations. Separate assembly areas are used for various body types, particularly the Hawks and station wagons, but all types are merged onto the body finishing line.

Our major interest in the Studebaker-Packard installation centers in the body finishing line. The entire finishing system was revised, where it was not completely replaced, by newly-designed equipment. The entire finish coat operation, like that already described for certain sheet metal parts, is new. Other units and details have been installed at various points in the line, such as the garnish molding oven and all automatic transfers.

The total line is essentially in a rectangular layout, utilizing available plant space. The direction of the line is reversed three times, but may be considered as a continuous linear flow.

*All temperatures are given in degrees Fahrenheit.

Start of Paint Preparation Work

When each body shell is received on the second floor — which houses the paint preparation and paint area — it is manually placed on a paint truck or buggy. A single type of truck is used to carry all body types. The body remains on the same truck throughout the finishing process, and even through part of the trim work which follows on another floor.

The paint truck is placed on a floor conveyor by means of an electric tractor. This conveyor takes the body through a six-stage cleaning and phosphating unit without any transfer. This series of operations takes 17 minutes. The stages are:

1. Preliminary cleaning in a mildly alkaline cleaner at about 108°.
2. Cold water rinse, at room temperature.
3. Phosphating for one minute at 100°.
4. Cold water rinse at room temperature.
5. Mild chromic acid rinse at 100°-110°.
6. Deionized water rinse, to remove any hard water salts or chromic acid salts that may have been deposited during the preceding stages.

The basic equipment used in this six-stage process is not new, but has been revised to allow conversion to the relatively new process of cold phosphating. This has been found to be a major advantage in plant efficiency, working conditions, and economy. Worker comfort has been notably improved, as the temperatures near the unit have been lowered. This becomes particularly important during the summer months, but is also a year-around advantage.

The consumption of steam has been dropped drastically, as heat requirements were decreased. The comparative temperatures required under the old hot phosphating process, which may be compared with those already described were — 160° for the cleaner, 130° on the phosphating unit, 120° on the chromic acid unit, about 130° on the first water rinse, and about 120° on the second. The result is a saving in steam consumption alone of about 15,000 pounds per hour. At current production costs, this means a saving of about $50 a day, or $12,000 in a work year—a sufficient amount to make the switch to the cold process very desirable.

As the bodies emerge from the deionized water rinse, they receive a compressed air blowoff—first from stationary units and secondly by manual application to certain points difficult to



Bodies automatically transferred from one conveyor line to split lines upon entering gas connection curing oven.



Placing glass fiber shield over painted garnish molding for protection against outside body enamel overspray.

reach. They continue on to an automatic transfer point, entering (by means of another conveyor) the phosphating dry-off oven. This is a gas-fired convection type oven maintained at 350°, which requires ten minutes for the parts to pass through.

The bodies then enter a cooling tunnel for one minute, in which they are cooled to approximately room temperature. Outside air is pumped through filters into this tunnel, and exhausted to the atmosphere, at the rate of about 10,000 cfm.

Primer Coat

The material then passes through an electrostatic spray booth, which deposits two successive coats of an alkyd primer. The next unit is a manual spray booth, 70 feet long, used for primer reinforcing, on exterior areas. It is also used to reach by manual spray certain areas inside the body which are inaccessible to the electrostatic sprays. The rear exterior of the body, for instance requires additional treatment. This manual spray booth is of the downdraft water-washed type, with air volume at 15,000 cfm per lineal foot of booth.

Both booths, electrostatic and manual, were revised in the recent plant changes, to increase both velocity and volume. The average thickness of the two primer coats deposited runs 1.75 to 2.0 mils.

As the bodies emerge from the manual spray booth, they are transferred by means of an electric truck from the floor conveyor to an on-edge floor conveyor running parallel but in the opposite direction. Two parallel conveyor lines of this type start at this point, each running through the prime oven. This oven was reconstructed, to decrease the length but to increase the heat for faster production, and is now a zoned type oven. The use of twin lines through it also increases the rate of output.

Beyond the oven, the bodies pass for one minute through a cooling tunnel, with an air volume of 10,000 cfm, in which they are cooled down to approximate room temperature. At this point, the two separated lines unite by means of an automatic switch.

Also at this end of the primer line, there is a manual transfer point, which may be used to switch bodies to a reserve line used for storage only. This has a capacity of 40 units, and is used, for instance, in case of breakdown of the automated line beyond that point.

General sealing operations follow. Joints are sealed against all possible water and air leakage. This is a manual operation, following the lines of the various body designs. An asphaltic seal is used for waterproofing, an alkyd for the seams, and plastisol for the drip rail and exterior fender seams.

The bodies proceed to the water sanding deck, where 320 grit paper is used. An inspection is made, and highlighted areas requiring sanding are noted. Only the areas and spots where imperfections are found are sanded. Two operators then seal the drip rail at the roof on all four sides, using a flow type calking.

Between the sanding deck and the drip rail sealing station is an automatic transfer point, which may be used to remove bodies from the line for transfer to one of two short conveyors located nearby between the main line segments. These short conveyors are used for storage, particularly overnight. Thus bodies do not remain in the spray booth, next stage in the process, overnight, but may be replaced on the line at this point in the morning.

Finish Coat Work

Beyond the drip rail station, the bodies enter the garnish molding spray booth. It is at this point that the decision on final coat color is made in connection with each unit. The selection of both basic color and trim is made here, based upon existing car orders, and the color choices are suitably coded upon each unit, as the guide for both garnish molding and body coat operations.

The garnish molding booth, which is 50 feet long, uses downdraft spray. Spray, as in the larger booth operation, to follow, is manual, in accord with the color instructions given for each unit. Air volume is 15,000 cfm. per lineal foot of booth.

Beyond this booth, the line is divided into two by an automatic switch, which normally delivers the bodies alternately to the two lines. This may also be manually controlled to switch any particular unit or units onto a desired line. A taxicab body, for instance, may require some special details or handling and may be sent down a designated line for that purpose.

The use of two lines from this point to the end of

basic finishing operations is an important factor in achieving a satisfactory total production volume, as well as in quality control. The presence of two lines has made it possible to keep the speed down to a point that assures an excellent finish job. The normal output for each line is 52 units per hour — or a total of 104. In case of the breakdown of one line, the other may be speeded up somewhat to continue a good rate of production.

The automatic switch directs the bodies onto a double on-edge chain conveyor, which takes them through a newly-installed oven for the garnish molding bake. This is a gas-fired convection type oven, operating at 260°, in which the units remain for 30 minutes.

The main body line from this point on is a completely new installation.

At the exit end of the oven, an automatic transfer is made to twin conveyors, which are the final preparation lines for the enamel finishing operation. At this point, provision is also made for manual transfer of bodies to two auxiliary conveyors, which have adequate unit capacity to store bodies overnight, so that they will not remain in the spray booth.

On the preparation lines, the bodies receive a final going-over. They are given special manual cleaning with naphtha, and tack-ragged as necessary. Any sealer spots are removed.

Plastic masks are temporarily installed on this preparation line to protect the garnish molding already applied and dried. These may be reused indefinitely, and are held in place by a small amount of adhesive tape. They are installed by an operator on each side of the line, working in two pairs. This use of the plastic masks results in substantial savings. The amount of masking tape required is greatly reduced, and it is figured that at least eight less persons are required for the operation. Four operators were necessary for the old process of simply removing the masking tape.

The bodies are automatically transferred to a 458′ on-edge conveyor, which takes them into the twin 125-foot long manual spray booths.

Air volume in these enamel spray booths, where the two critical general body coats are applied, is 17,000 cfm. The air is preheated by gas, first passing through two sets of filters, then through steam reheat coils, a steam and humidity control, and finally to the top of the spray booth for ventilation.

The air in the booth is thus heated to about 80°, moisture-controlled to 50 percent relative humidity, and cleaned. This relatively high temperature is required to compensate for the high velocity of air movement in the booth, which would evaporate skin moisture too rapidly, and also to improve the flash-off of solvents in the paint.

Each body may be spaced only five feet apart in this booth operation — and covered without any overspray, with a complete change of main color for each body if necessary. This is accomplished by means of the downdraft system with high volume of directional air flow.

Compressed air used in the spray system passes first through an aftercooler to remove moisture, and then through a large air filter to remove any remaining contaminants, before being piped to the spray booth for distribution through individual spray guns for each color.

Each spray station in the booth is equipped with 16 spray guns, connected with separate circulating systems for each color. Nine of the systems are used at present, leaving seven for reserve as required for emergency or future color requirements. Special colors are sprayed in the same booth, working from small separate paint pots.

In the case of two-toned cars, the first tone is given in the garnish molding booth, and the second tone in the main spray booth.

The operators use an air hose with a quick disconnect, so that it may be rapidly switched from one color to another. This makes possible the close spacing of the bodies on the line, and change of color from one unit to the next. In practice, some attempt is made to run a number of units of the same color through in sequence, but the variety of color requirements and production volume make this quite difficult.

The complete exterior is covered in the twin booths, and those interior sections which will not be subsequently covered by upholstery or trim — essentially the trunk interior and door jambs.



Spraying body enamel into trunk area in new color spray booth.



Application of corrosion resistant primer to exposed underbody parts.

The enamel applied to the body is a high melamine enamel, or superenamel, two coats being applied wet-on-wet by successive operators in the same booth. The thickness is 1 mil for each coat, giving a total finish thickness including primer of 3.75 to 4.0 mils.

The last enamel coat is followed by a two-minute air flash-off. The bodies then enter a gas-fired convection type oven, remaining for 31 minutes at 260°. This oven is provided with ample ventilation to assure a very high degree of luster on the finish.

Conclusion

From the final bake-off oven, the bodies move, without any special cool-off procedure, to an automatic transfer point. Here they move onto automatic raisers (or elevators) which take them to the fourth floor trim department. The fifth and sixth floors are also used for trim operations. The fourth floor was formerly the final enamel area, but was released for needed trim area with the new finishing installations.

On this floor there are also five short bank lines which allow feeding the trim lines with the various body styles so as to assure a good balance of output during the remaining operations. Finally, from the sixth floor trim department, a monorail conveyor takes the trimmed bodies across open spaces and over the roofs of other buildings to the final assembly building, over half a mile away. Total length of this chain, including return, is 6,350 feet.

A separate sheet metal finishing line is operated in another building — for fenders, hoods, and miscellaneous small parts. No major changes have been made in this system for several years, and it need only be summarized — six-stage phosphating operation, flowcoat primer, gas-fired bake oven, side-draft enamel spray booth, gas-fired bake oven. These parts are then ready for delivery to final assembly.

The production control department is charged with the basic responsibility for scheduling — to see that the right number of fenders of the right color are on hand to join the body unit in the assembly routine. Each part must be on hand in the right quantity, in the right sequence, and at the right time.

There is a small final refinish line, following final assembly. Cars are given a thorough final inspection, and any finish scratches or defects are remedied in a special manual spray booth. Such cars are placed on a special flat top floor conveyor which takes the entire car. A special oven then provides the necessary bake for the retouching.

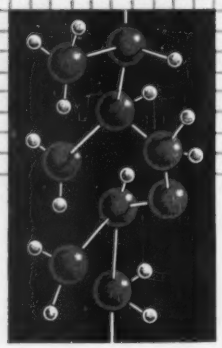
In a fiercely competitive industry, paramount reliance is being placed on product quality in detail for sales appeal. This perhaps reflects the concentrated plant layout of this firm — it is the only American auto company to have all production operations and administrative offices in the same plant area, and there is a natural intimacy of contact between production worker and management.

Pride is taken in the speed of the finishing line, with its rate of 104 cars per hour through the twin spray booths, considered by some to be one of the fastest lines in the industry. This is achieved despite the great diversity of styles and colors on this line, and the resultant absence of automation in the enamel coat application.

The installation of the new equipment has made possible improved product quality. The new system for application of aluminum weld-through primer on specified small parts (on the first floor) is this company's effective answer to the problem of rust corrosion on rocker panels and other underneath-fender parts.

It will be noted that iron phosphate is used in the phosphating process on these parts, while iron zinc phosphate is used on the rest of the body in the regular line. By rustproofing in this manner prior to welding operations, to join the various components to the body shell, it is found that the joints are fully protected. Metallurgists point out that if the welding is done first, the subsequent application of rustproofing cannot protect the two joined metal surfaces, since there is no flow-through between them.

In the final stages, a major reason for the completely new system at this point is the demand of company stylists for a high luster finish. No polishing is done after the car leaves the spray booth — it must come off the line ready for sale. Other key requirements are that it must be dust-free, and have a minimum of orange peel. The new finishing system assures a product meeting these stringent requirements, with practically no special or hand work.



SYNTHETIC RESINS

The Backbone of Modern Finishes

A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part IX - Polystyrene

By Harold P. Preuss

THE first literature reference to the chemical styrene was made in 1839. However, it remained largely a laboratory curiosity until about 1930 when a development program commenced simultaneously in the United States and Germany. Large scale commercial production of the styrene monomer was undertaken in the United States in 1937.

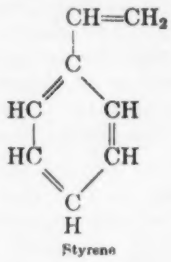
Styrene is of particular value to industry because of its widespread usefulness in the manufacture of polymers and a huge number of copolymers. One of the most important of these groups are the styrene-butadiene copolymers discussed in the previous article in this series.

Earliest attempts to use high molecular weight styrene in surface coatings employed the approach of solution in a suitable solvent along with plasticizer to yield a film by evaporation of the solvent. Unfortunately, in this form, styrene polymer proved to be a difficult material to plasticize and the films were often subject to crazing and showed poor adhesion. In addition, these solutions showed high viscosity at low solids and a tendency to "web" during spraying. These detriments, coupled with the incompatibility of polymerized styrene in this form with conventional film-formers, prevented its general acceptance as a solution coating resin. When styrene was introduced as a modification with vegetable oils or alkyd resins, or as a co-polymer with unsaturated materials, it became more interesting as a coating raw material.

Polymerization of styrene monomer in the presence of water produces a dispersion or latex of high molecular weight styrene polymer, at high solids content, in an easily handled form. It has been found that plasticizing polymerized styrene in this form overcomes the previously observed detriments of impractical application properties, film crazing, and poor adhesion, allowing a high quality film to be cast from an emulsion vehicle.

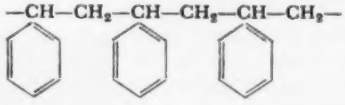
Polystyrene has a number of outstanding features, including freedom from taste and odor, good clarity, good electrical properties, excellent dimensional stability, resistance to many corrosive chemicals, as well as resistance to growth of molds and fungi. Probably its most outstanding feature, however, is its economy; last year the price dipped to a new low of 18¢ a pound for some types.

Styrene monomer has the following formula:



Styrene

The polymerization of styrene proceeds easily, under the influence of heat and/or an initiator. The polymer has the following regular structure:



This resin is a member of the hydrocarbon family of resins, discussed in Part I of this series of articles, which appeared in June, 1960.

Fig. 1 illustrates in diagram form the origin of styrene as well as the method of making polystyrene.

Manufacturers of Styrene Polymers

Styrene monomer has found numerous uses in protective coatings. In addition to its use as the copolymerizing agent in styrene-butadiene resins, it is used extensively in the improvement of drying oils and alkyd resins by "styrenation." Styrene polymerized alone is readily soluble in aromatic hydrocarbons, but its use in protective coatings is limited because of its brittle nature. Nevertheless, there are several U.S. companies that make special polystyrene resins for use in

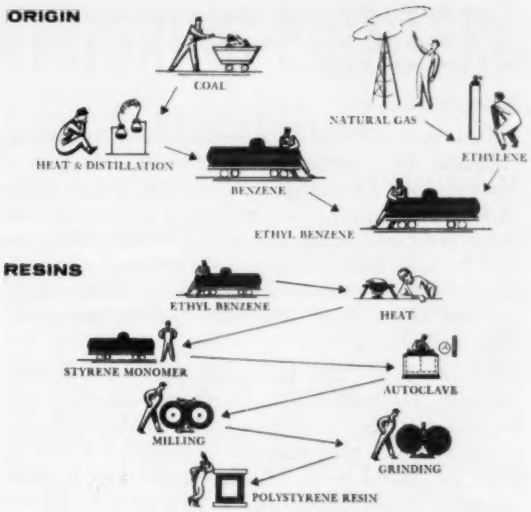


Fig. 1. Sources of Polystyrene Resin.

formulating coatings for application to metals. In this article we will discuss those made by:

Monsanto Chemical Company, Plastics Division, Springfield 2, Mass.

The Dow Chemical Company, Plastics Dept., Midland, Michigan

Marbon Chemical Division of Borg-Warner, Washington, West Virginia

MONSANTO

Lytron 810 and *820* are acidic styrene copolymers made by Monsanto Chemical Company. Furnished in the form of fine powders, these resins can be dissolved readily in aqueous alkaline solutions and in certain alcohols, ketones, esters, or mixtures of these and aromatic hydrocarbons. Coatings of these resins properly plasticized and deposited from either aqueous or organic solutions yield useful coatings. Physical constants of these resins are found in Table 1.

Films of Lytron 810 and 820 deposited from organic solvents are water resistant, but remain soluble in alkaline water or organic solvents unless they are insolubilized. This feature makes it possible to produce temporary coatings with good adhesion and protective value which can be easily removed after they have served their purpose. These coatings offer better protection than strippable coatings and are not so susceptible to accidental peeling from vital areas during the processing of protected parts but they are just as effectively and completely removed when no longer needed. A typical use for these removable coatings is in the protection of parts during fabrication.

Most aqueous solution applications for Lytron 810 and 820 depend on the reaction between these resins and ammonia to form a water soluble salt which releases ammonia on drying or with gentle heating to yield water insoluble films.

Lytron 810 is readily solubilized by alkalies such as sodium and ammonium hydroxide. Aqueous solutions of up to 40% are easily obtained, if sufficient agitation and heat are used. At the higher concentrations, the heat of neutralization is normally sufficient to keep the mass fluid during the solution process.

Since films of Lytron 810 deposited from either aqueous alkali or organic solvent solutions are brittle after drying, it may be advantageous in some cases to impart some degree of flexibility. This can be accomplished by the addition of plasticizers to the resin solution. Long chain glycols, fatty acids, and fatty acid amines are very effective when used either in aqueous or organic solvents.

Unmodified Lytron 820 films from ammonia solution even after drying at room temperatures are not water soluble. Resistance to softening with water increases with longer drying or elevated temperature drying, for example, 1-5 minutes at 100°C. Water soluble amino resins, polyhydroxy compounds, formal-

TABLE 1

Properties of Styrene Type Paint Resins

Manufacturer	*Resin*	*Physical Form*	*Specific Gravity*	*Acid Number*	*Solution Color*	*Index of Refraction*	*Softening Range °F.*
Marbon	1100 TMV	Granular powder	1.02	—	Sl.yellow	1.58	
	9200	White Granular powder	1.05	—	Sl.yellow	1.58	365
Monsanto	Lytron 810	Fine powder	1.26-1.28	315-325	—	—	356
	Lytron 820	Fine powder	1.14-1.16	180-190	—	—	None below decomposition temp.
Dow	PS-2	Flake	1.06	1	—	1.59	140-200
	PS-3	Flake	1.06	1	—	1.59	200-240

dehyde and polyamines are effective cross-linking insolubilizing agents.

Excellent heat resistance and a non-flammable application medium make Lytron 810 of interest in the coating field. Conventional methods, i.e., brushing, dipping, spraying or roller coating may be utilized when applying a coating of this resin.

The addition of 4-12% Lytron 820, in alkaline solution on the latex solids basis, to non-film forming latices which normally yield crazed opaque films at room temperature, often eliminates the crazing in thin films and results in the deposition of a film that may subsequently be fused to a clear, continuous craze-free film.

Dow

The Dow polystyrene resins are clear, colorless, thermoplastic materials designed for coatings applications such as utility lacquers, etc. Readily soluble in inexpensive solvent mixtures of aromatic and aliphatic hydrocarbons, these resins produce coatings which have excellent electrical properties, chemical resistance, water resistance, and color. The resins are known as *PS-2* and *PS-3*. The lower viscosity of Resin PS-2 permits the formulation of higher solids coatings. The higher molecular weight of Resin PS-3 results in slightly better end-use physical properties.

PS-resin films deposited out of solvent solutions are clear, continuous and glossy. However, the PS-resin films do have limited flexibility. Efforts to improve the flexibility of these films by the addition of plasticizers are not too successful. The resins have a narrow threshold of plasticizer acceptance — after slight initial softening, tack and temperature sensitivity may be encountered.

Dow Resins PS-2 and PS-3 are soluble in aromatic hydrocarbons, esters, ketones, chlorinated solvents, etc. They are insoluble in alcohols. Recommended solvents are aromatic hydrocarbons such as toluene or xylene. Toluene solutions of the PS-resins are tolerant of less expensive hydrocarbons — troluoil for example — and accept large volumes without consequent resin precipitation. When aliphatic hydrocarbon solvents are used, 5-20% aromatic hydrocarbon is required to give usable solutions.

The solubility of Resins PS-2 and PS-3 in such a wide range of solvents makes it possible to develop coatings which may be brushed, dipped, or sprayed.

The Dow PS-resins are compatible with a wide range of plasticizers. In general, they are compatible with phosphates, phthalates, sebecates, and abietates, are incompatible with natural oils such as castor, and with most of the stearates, oleates, and ricinoleates.

Many of the applications for Resins PS-2 and PS-3 are useful because of the excellent electrical properties of these materials. The properties, typical of quality polystyrenes, approach those of a "perfect" insulator.

These resins are unaffected by long exposure to most inorganic alkalies and acids. They are not affected by alcohols, glycols, dilute soap solutions, or dilute phenol solutions.

The simplest utility lacquers made with PS-resins are resin/solvent solutions adjusted to the desired application viscosity by varying the amount of resin to solvent. Colored utility lacquers are made by adding dyes or pigments. Such lacquers may be used as coatings over metals, etc.

Marbon

Two types of styrene polymers are made by Marbon Chemical for coatings use. These are known as *Marbon 1100 TMV* and *Marbon 9200*. Paints based on these resins provide a high degree of chemical and water resistance in an air drying vehicle. They are used for such applications as metal primers, aluminum paints for high temperature service, clear chemically resistant lacquers, etc. Properties of the resins are given in Table 1.

Marbon 1100 TMV is a good binder for metallic pigments. The resin is neutral and does not react with the metals or affect the leafing quality of aluminum pigments. It can be used with zinc powder and coated on fresh galvanized metal. The resin contains a small amount of residual unsaturation. This makes possible a degree of convertability or cross-linking when the formulations are modified with conventional paint driers. Occasionally this is useful to improve the hydrocarbon solvent resistance of coatings. A wide range of solvents can be used with Marbon 1100 TMV. The resin is soluble in most chlorinated hydrocarbons, ketones (other than acetone), esters, etc. Coatings of the resin are formed by the simple evaporation of the solvents. Air dry coatings with a wide range of drying speeds can be obtained.

Marbon 9200 resin is a tough film-forming lacquer type vehicle. It is a thermo-plastic, linear styrene copolymer which will form a protective coating by a simple evaporation of the volatile solvent. The resin produces durable, impervious coatings characterized by a high degree of resistance to acids, alkalies and oils. Its coatings have excellent water vapor transmission resistance. The films are also odorless, tasteless and non-toxic. The resin may be modified or plasticized to produce coatings with a wide range of flexibility and hardness. The resin is available in four solution viscosity grades.

In addition to the pure resin powder form, Marbon 9200 resin is available in a range of pigmented color chips. The paint color chips are well dispersed high quality pigments ground in the resin. Since the pigments are already thoroughly dispersed, high gloss enamels or other finishes can be prepared simply by stirring the chips into a suitable solvent and adding desired plasticizers. A large number of white hiding pigments, extenders, toners and lakes are available in this medium.

Marbon 9200 has good solubility in most types of solvents except the alcohols and straight aliphatic hydrocarbons. The aliphatics can be used as diluents, however, even in large proportions. A solvent combination which has been found to work well in practical formulation is equal parts of high flash naphtha and mineral spirits.

The above companies, as well as a number of other firms, make additional polystyrene resins having various properties, but these are not used in formulating coatings for metal substrates.

(*Continued from page* 91)

FINISHING POINTERS

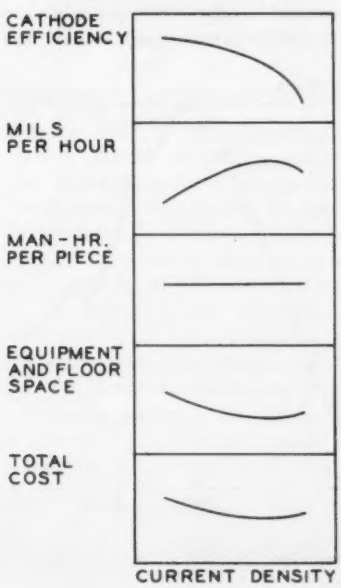
PRODUCTIVITY

By J. B. Mohler
Consultant, Seattle, Wash.

THE responsibility of the production engineer is to increase production without increasing labor cost and with only minor increases in equipment cost. This, really, is the basic story of industry that brings about an ever increasing standard of living. It is best described as "productivity." To the designer it means that equipment must be provided to produce parts at a forecast rate. But, it must be anticipated that production eventually will be doubled without providing more equipment. To the plater it means that plating rates will be increased.

Productivity is the necessary quality at the highest possible plating rate in the area most difficult to plate. Unfortunately plating rates cannot be increased merely by increasing current density. The cathode efficiency of a sodium stannate bath, for example, will readily decrease as the current density is increased. As a consequence, the plating rate will not increase and bath control will become more difficult. Control costs will go up, productivity will not be increased, and the total costs will be higher. Success may be no better with a nickel bath. The cathode efficiency will remain high as the current density is increased. However, throwing power and plating range become limiting factors. The plating rate will often be reduced in a difficult area, as a result of increased current.

The plater who is concerned with the possibility of increased plating rates will look to the limitations of the plating baths. An original bath should be selected that has the requisite potentialities to increase plating rates. This should take into account the change in cathode efficiency with change in current density, the throwing power, and the plating range. Also, the plating cycle must be considered. Can the plating rate be improved by changing the bath formulation or by the use of a different type of bath? The limitations of an alkaline tin bath can be circumvented by converting to an acid tin bath, but this change may require additional cleaning and striking steps. Tank space must then be available. The stannate bath is preferred because of inherent cleaning ability and excellent throwing power. The loss in cathode efficiency with increasing current density can be offset, to some extent, by operation at maximum temperatures and concentrations. These factors are definitely limited, but can be extended by converting from a sodium to a potassium stannate bath. The potassium bath becomes the ace-in-the-hole when the original work is planned with the sodium bath.



Alkaline and cyanide baths, in general, possess good throwing power and are not as sensitive to cleaning troubles as the acid baths. Acid baths, on the other hand, lend themselves to very high plating rates with proper agitation or movement of the work. However, we should not use generalities as a guide. After all, there are really only a few basic baths, so that a decision should be made to satisfy each application. The original decision should be made, for example, between an alkaline tin bath and an acid tin bath, based on the fundamental limitations of each.

Agitation offers one of the best possibilities of increasing plating rates. Although it is not effective in baths limited by cathode efficiency, such as alkaline tin and chromic acid, it is very effective when applied to high efficiency cyanide and acid baths. For instance, silver plating rates can be tripled by cathode movement of 10 to 30 feet per minute. The same result can be accomplished by moving the solution, although it is difficult to move the solution so that all parts in the tank are properly exposed to the flow. Simple mechanical agitation is helpful but effective flow of the entire tank volume requires a pump and proper design and placement of flow inlets and outlets. Plating rates can be increased manyfold by the use of high effective flow rates.

Notice that increased plating rates do not decrease man-hours when sufficient tank space is available. If the plater is kept busy racking and unracking and moving the racks, then he will be able to move and rack no more pieces per hour regardless of the plating rate. Increased plating rates, then, save only equipment and floor space. Frequently this is important, since floor space and capital funds often are not available. On the other hand, cleaning, pickling, and rinsing tanks usually are more than adequate when the plating tank is used to capacity. Therefore, a second plating tank will double capacity, without increasing the plating rate. If the operation is automatic, then doubling the size of the plating tank becomes difficult. It is this sort of situation where one wishes to do twice as much work with the same amount of equipment. Somehow too, it always seems to turn out this way. It is best to assume that future demands will double the rated capacity and to be as generous as possible with the original design.

Control of Alkaline Tin Plating Baths

A Luminescent Method

By Larissa Domnikov, *Process Analyst A, Norair Division, Northrop Corporation.*

A NEW rapid method of analysis of alkaline tin plating baths was reported from the Kiev State University and described in the Bulletin of the Academy of Sciences of the U.S.S.R.[1] and in the technological journal Plant Laboratory.[2]

One of the major disadvantages in the operation of alkaline tin plating baths in which tin has a valance of 4, is contamination of the solution with the bivalent tin, since in the process of electrolysis the tetravalent tin is reduced to the bivalent state. Contamination with Sn^{++} ions results in poor tin deposits. Therefore, the development of a sensitive, rapid method of analysis for small concentrations of the bivalent tin is an important achievement.

Such a method was developed by three Russian researchers at the University. They established that Sn^{2+} ions luminesce in certain solutions, whereas, the Sn^{4+} ions do not possess such a property. On the basis of this discovery the researchers developed a luminescent method of analysis of the divalent tin.

They analyzed baths containing 10 g./l. of free alkali, 6 g./l. of sodium acetate and 90 g./l. of sodium stannate. The analysis of baths of such composition presents the greatest difficulties. The absolute sensitivity of the method was established on the basis of luminescence of divalent tin in concentrated sulfuric acid; in this solution the luminescence of tin is highest (13%) and its spectrum lies in the visible region convenient for observation[3] (Fig. 1). The luminescence is excited by ultraviolet light with a wave length of 200-250 millimicrons from a high-voltage spark of zinc electrodes. The ultraviolet light is directed by means of a quartz lens to a container with the solution (Fig. 2). The container has to be made either of fused quartz of good transparency to ultraviolet light, or has to have one wall of crystalline quartz.

To determine Sn^{2+} in the electrolyte, it is necessary to take a sample of the solution near the anode and dilute it with 50 volumes of sulfuric acid. The tests indicated that a noticeable luminescence appears with 0.1 g./l. Sn^{2+} in the electrolyte. The allowable concentration of the divalent tin in the electrolyte is 2 g./l. Such a low sensitivity for the luminescent method is due to the presence of a high concentration of Sn^{4+} ions, whose absorption spectrum considerably overlaps the absorption spectrum of the divalent tin, decreasing the intensity of the exciting beam. The luminescence of the solution of $Sn^{2+} + H_2SO_4$ is sufficiently intensive, so that it can be detected with a selenium photoelement with an intensifier, or with a photomultiplier.

The possibility of photoelectric detection of the luminescence permits making the control method automatic. For this purpose, with the help of a mechanical device a sample is taken near the anode and is transferred to a container with sulfuric acid. The container

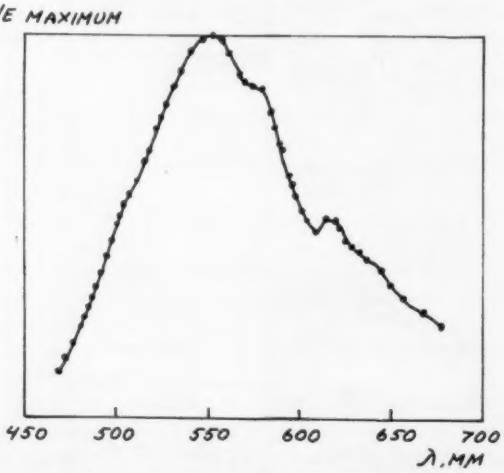


Fig. 1. Luminiscence spectrum of tin in the concentrated sulfuric acid.

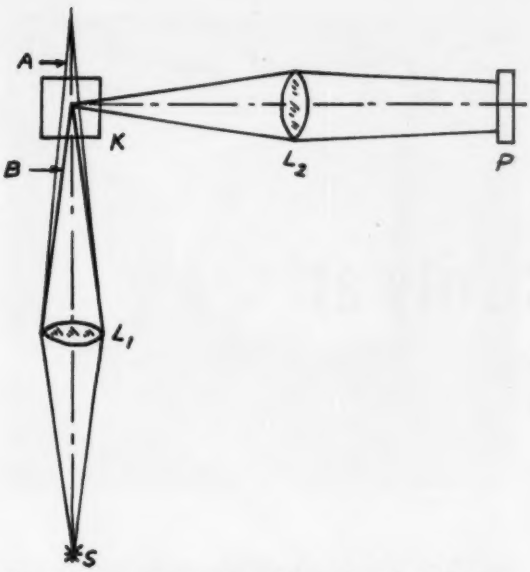


Fig. 2. Diagram of excitation and detection of the luminiscence: S—condensed spark with zinc electrodes; L_1—quartz lens; K—container; L_2—glass lens; P—photoelement; A—visible light; B—ultraviolet light.

is illuminated with the exciting beam from a high-voltage spark at certain regular intervals. With the help of a second glass lens L_2 (Fig. 2), the luminescence is directed onto the photoelement whose electric current through a special relay signals the presence of Sn^{2+} ions.

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SYNTHETIC RESINS

(*Continued from page* 88)

Identification of Styrene Polymers

The following test[4] is characteristic of styrene resins as well as styrene containing mixed polymers (for example, styrene-butadiene polymer):

A little of the sample is taken to dryness with four drops of fuming nitric acid (Sp.Gr. 1.15). The residue is heated directly in a micro test tube over a flame, starting at the middle of the test tube and heating downward. The mouth of the test tube is covered with a disk of filter paper soaked in an ether solution of 2,6-dichloroquinone-4-chloroamine, and then dried. After heating for about one minute, the paper is then exposed to ammonia vapor. A blue stain indicates the presence of phenol, formed in the process of heating the styrene polymer in the presence of nitric acid.

Perspective

Although polystyrene as such is not used extensively in formulating coatings, its use in the molding field has been increasing by leaps and bounds. Its copolymers, however, are used extensively in coatings. In addition to the styrene-butadiene copolymers discussed in our last article, the styrenated alkyds, mentioned previously, are used extensively. In this case the styrene contributes toughness, durability, paler color and rapid drying characteristics to the alkyd resin. These styrene-alkyd copolymers will be discussed in our next article.

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4. Modern Plastics Magazine. January, 1961 and May, 1960. Breskin Publications, Inc. New York, N. Y.
5. Literature supplied through the courtesy of the firms mentioned in this article.

A Reader's Suggestion

In the Shop Problems section of the January 1961 issue our technical editor, *Nathaniel Hall*, answered a subscriber's inquiry regarding cyanide determination in wastes. A reader, *James J. Tharp* of Neosho, Mo., has suggested another simple method of determination, which is as follows:

REAGENTS:

Phenolphthalein Solution:

1. To 90 ml. distilled water in a 250 ml. beaker add 0.10 g. phenolphthalein and 1.0 g. sodium hydroxide. Stir to dissolve.

2. Add 10 ml. buffer solution (90 ml. distilled water, 10 ml. glycerine and 1.50 g. copper sulfate crystals). Stir.

The phenolphthalein solution should be made fresh every two weeks.

Standard Cyanide Solution:

1. Place exactly 0.2502 g. potassium cyanide in a one liter volumetric flask and fill to mark with distilled water.

PROCEDURE:

1. Add 100 ml. of the waste solution to a Nessler tube (#1).

2. Add 100 ml. of distilled water to another Nessler tube (#2).

3. Pipette 5 ml. of phenolphthalein solution into each Nessler tube and mix thoroughly.

4. Add standard potassium cyanide solution from a burette into Nessler tube #2 with constant mixing, until the color matches that in tube #1.

Ml. of standard potassium cyanide required to produce a color match is equal to the parts per million (p.p.m.) of cyanide in the waste sample.

We thank Mr. Tharp for his interest, and wish to remind our readers that their suggestions and comments are always welcome.

Diversified Plating Activity at New Smith-Erie Plant

By Walter Rudolph

JUST getting into full swing, the new plating department of Smith-Erie Division, A. O. Smith Corporation, Erie, Pa., follows closely on this firm's acquisition and expansion of the former Erie Meter Systems, Inc. Smith-Erie has some 110,000 square feet of new manufacturing area, nearly doubling the former facilities.

New products were added to existing product lines, making the company today the world's largest manufacturer of petroleum measuring meters, and taking strides toward world-wide leadership in the handling and measuring of fluids.

Naturally, this expansion posed new problems in cleaning and plating of components for meters and other products. Much if not all of this phase of manufacturing was being done outside the plant. The firm, months ago, began organizing a work-flow cleaning and plating department, taking over a section of the old Erie Meter plant about 44 x 120′ in floor area with a high bay roof.

Much more than plating is done here — it is planned so that parts will enter one end of the lengthy room and, as is required, will receive deburring, tumble cleaning, grinding, etc., and even get hydrostatic testing if need be before issuing from the opposite end of the department, ready for stocking or assembly routing.

Diversification is a must in this new department, because one finds everything from fractional ounce brass or other metal parts, to four or five hundred pound castings requiring cleaning and plating work prior to meter assembly. There is much hand or manual work; sanding for instance using 80-200 grit paper, and portable power sanders and grinders, as well as various sizes of barrel tumblers with ceramic stone, and others that do ball burnishing or polishing. (Fig. 1.)

From deburring, grinding, sanding, polishing, etc., much of the work load is routed through degreasing

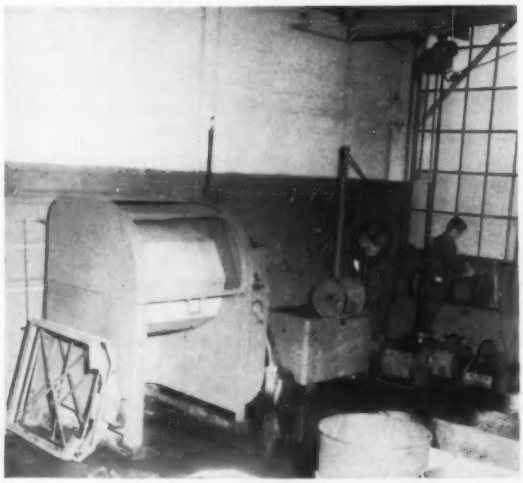


Fig. 1

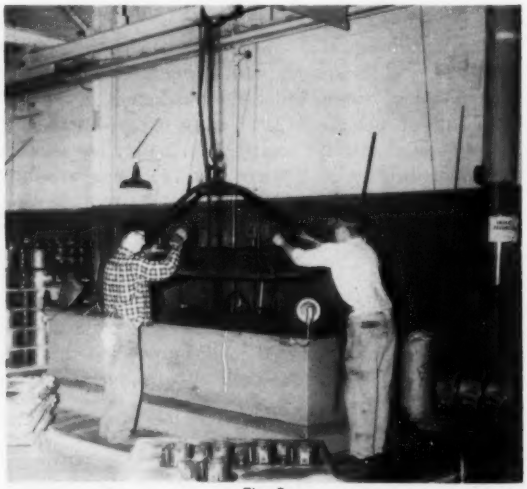


Fig. 2

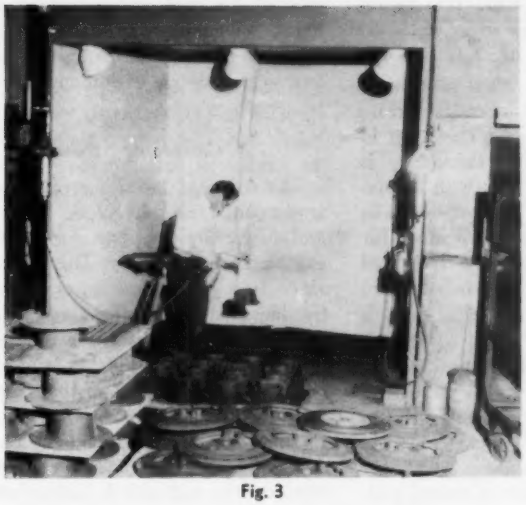


Fig. 3



Fig. 4

with standard trichlorethylene treatment (Fig. 2) then, leaving the "enter" end of the plating department, the parts start down the work-flow cleaning and plating tank lines, two in number, which take up most of the department floor area.

Taking the two plating lines in order, starting against the wall with one, the other occupying much the center of the room: it is interesting to note that a great deal of the plating facilities here were installed after being salvaged from the former Smith plant in California, which was in meter production. It should be pointed out that the carefully planned and integrated new plating department is precision controlled and has maximum control safety by location of electrical switching on a special control panel just outside the plating department proper.

In the first plating line, are two bright copper tanks, which process springs, tubes and small parts. Cadmium plating in one still and in two barrel platers is applied to both metal fabrications and castings. Small parts such as nuts, gears, meter shafts, and even larger items, go into the barrel equipment, one an 85-gallon and the second a 250-gallon facility. This line like the second line is worked from a modern power-rail and hoist setup traveling each line directly overhead.

Many cast aluminum parts, following machining and degreasing, go through etching procedure at the next work station in the wall line of tanks. Cleaning is done with hot alkali solution, followed by rinsing, and etching in about 90% phosphoric acid at room temperature. Customer preference dictates etching.

It has been found aluminum etching aids when two machined parts, for instance, are to be joined with adhesive and rough surfaces are desired; etching also removes scum and dirt that might otherwise impede joining.

Aluminum meter parts might also get standard anodizing which is next in the wall line of tanks. This prevents corrosion of any aluminum not painted or otherwise given specific treatment. The oxide coating is built to customer required thickness, varying extremely, up to 0.0005" for instance. In some metering, if parts are not anodized, they might whiten (similar to steel rusting), which is undesirable. Anodizing starts with a 15% sulfuric acid solution, at from 68-72°F., sealing in chromic acid rinse, and hot water rinse.

Going to the other line of tanks, three of about 300-gallon capacity are used in chromating zinc-base die-castings; there is a cleaning dip in acid solution, about 3% sulphuric, then rinsing, then into a fiberglass tank for chromating. Another rinse, then parts are air-dried.

The last bank of tanks is set up for special phosphate treatment of meter parts; tanks are 500 gallons in size or larger, starting with an emulsion cleaner diluted five to one with kerosene. Spray-rinse follows, with a step-on valve and drainage right to plant sewerage.

Next the basket of parts goes into 210°F. water, and out and into dip phosphating solution for about 15 minutes. The iron and acid content of this dip are very critical and it is checked about three times a day by titration. Finally, there is a hot rinse at 190°F. before going into a sealer tank, slightly cooler, out of which parts come quickly and are air-dried.

The firm has still another treatment, which follows hot rinse stages, and which is sprayed on parts which are specified to have a special lubricative coating for their metering functions. These parts vary from small gears to large castings (Fig. 3). Spray work for this film coating is highly skilled in nature.

The film coating from this spraying might vary from 0.0002" to 0.0005". Over 80% of the lubricative particles are reported to be of one micron or less in size. The spray includes a bonding resin which most solvents such as gasoline, kerosene, hydraulic fluids and the like cannot disturb.

The coating comes in a paste and is mixed with the resin in proportions, three to one, or five to one, depending upon the coating job desired, and the number of times the individual part might be sprayed. The film is baked on in several ovens (Fig. 4), at 375°F., for one hour, regardless of part size. An exception is aluminum parts, which are baked at 300°F. or less, for up to two hours.

Science for Electroplaters

By L. Serota

This installment concludes Part LXV, Variables in the Watts Bath, of the series on Science for Electroplaters. The first half appeared in the May issue.— ***Ed.***

Thickness

The relationship of stress to thickness of deposit was investigated by A. Brenner and S. Senderoff while making stress measurements with the spiral contractometer which they developed. They found, for example, that a decrease in stress resulted with increased thickness of deposit. In support of this view, values of stress in deposited nickel obtained from a Watts bath operating at 55°C., 2.5 amp./dm.^{2}, pH 3.0-3-5, are recorded in Table 1.

TABLE I

Thickness Inch	*Stress, lb./in.^{2}*	
	S	S_T
0.0006	15000	16000
0.001	12000	13000
0.002	9000	11000

The values of stress in Table 1, under the heading S, represent the average values of the stress in the plated metal for a given thickness, and those under S_T the true stress. To obtain a more pertinent value of stress, for each thickness (increment) of the deposit, the term instantaneous stress was suggested. This value may be obtained by determining the slope of the average value stress curve.

The relationship between the two stresses, average and instantaneous, shown by the curve in Fig. 8, is based upon stress values obtained from electrodeposited nickel from a Watts bath. Curve A represents the values of nickel deposited on a stainless steel helix, Curve B, the bright or small grain size side of the metal, and Curve C the dull or large grain side on the electroformed nickel helix. The slope of this curve is smaller than that of the other two. The broken line represents true stress, S_t, while the solid line represents the instantaneous stress, S_i.

The curves reveal the fact that the lowest stress resulted when nickel was deposited on the dull or coarse grain, represented by Curve C. The drop in stress, with increasing thickness, is associated by the authors with the increased grain size of the deposit. The highest value is that indicated for Curve A. The lowest value indicated for instantaneous stress is obtained when the thickness of the deposit is 0.0005 inch.

S. Senderoff notes that little increase in stress occurs with increasing thickness when electrodeposits are obtained from a straight nickel chloride solution, thereby providing additional evidence that variation of stress with thickness does not result when grain size is uniform, as is known to occur in the chloride bath.

In answer to K. G. Soderberg's query about the reason for the minimum in instantaneous stress, exhibited in Fig. 8, at intermediate coating thickness, the anomaly between the minimum value and final constant value was interpreted by Brenner. He suggested such possible causes as slight binding of the Contractometer during the run and subsequent release, or stress-producing effects that occur at the beginning phase of the plating, and are relieved after a short lag.

The frictional binding of the Contractometer and subsequent release, which Brenner considered a possible cause for minimum stress values, was questioned by J. B. Kushner, who found in his development of the stress measuring instrument, the Stresometer, that the curve plotted, based upon results he obtained, showed the same minimum even though this instrument is not subject to friction.

The suggestion was therefore advanced that, in a comparison of stress values (with thickness of deposit), the equilibrium stress be used as the reference. Equilibrium stress is represented as the limiting value of the stress for the given condition of operation.

The equation, including this term to account for the sharp decrement in the first stage of deposition indicating the relationship of residual stress with thickness of deposit, with stress characteristics given in terms of limiting stress, is represented as follows: $S_a = A + B_e^{-kt}$, where S_a is average stress at thickness, t (deposit), A the equilibrium stress due to initial influence of the basis metal surface, e the natural logarithm, k a constant expressing the rate of damping equivalent to the inverse of some characteristic length.

Causes of Stress

The cause of internal stress in electrodeposited nickel, K. G. Soderberg and A. K. Graham note, has not been explained satisfactorily. This they consider, in a great measure, to be due to the fact that observations and calculations are not quantitatively reliable. A factor indicated in the cause of stress is the irreversibility of the reaction involving electrodeposition and the relatively high overvoltage necessary, especially in the transition elements iron, cobalt, and nickel. This effect results in a higher deposition temperature than the prevailing bath temperature; hence, removal will usually result, as in the case of nickel, in the loss of this excess heat and contraction of the metal.

Stress in electrodeposited nickel, R. H. Barklie reported, increases linearly with the deposition potential. Reduction in internal stress in deposited nickel may be effected, it is suggested, by increasing the temperature and/or superimposing alternating current, thereby reducing the amount by which the potential is displaced from its equilibrium value. Recently, V. J. Marchese obtained, as reported herein, stress reduction of electrodeposited nickel by superimposing 60 cycle alternating current on direct current in a Watts bath.

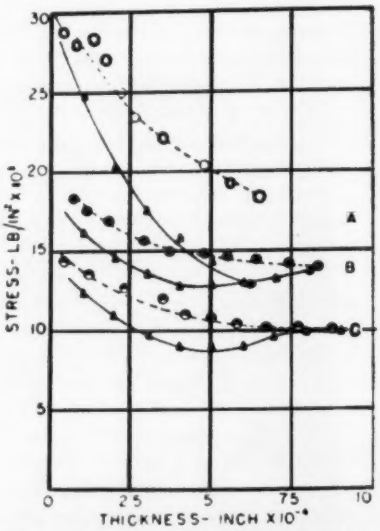


Fig. 8. Stress in nickel deposited from Watts nickel plating solution.

The acceptance of this view (excess energy) is questioned by J. B. Kushner, who points up its inadequacies in a number of cases. For example, does the fact that the presence of some compounds causes the deposited nickel to become compressive in nature indicate that the deposition overvoltage is lowered to the equilibrium value or lower, or that deposition of nickel occurs at a lower temperature than that of the surrounding plating bath? An improbable situation, Kushner contends. Further, the case of the increase in stress in nickel deposits in the presence of chloride ions, or the expansion of such metals as cadmium and zinc when deposited, provide, Kushner believes, additional evidence of the inconclusiveness of this theory.

The association of stress with inclusions in grain-boundaries, with greater stress exhibited by fine grain attributed to the greater surface, is considered a preferable explanation for the cause of stress. J. B. O'Sullivan proposed the colloidal hydroxide hypothesis, in which the higher pH of the cathode film is noted. This increased pH in the cathode film may be sufficiently high to induce formation of (colloidal) nickel hydroxide or a basic salt which, by nature of its charge, would be deposited together with the metal, an effect which may account for the fine-grained structure and excessive overvoltage observed for nickel.

A. Brenner and associates interpret the codeposition of foreign matter with its effect upon the properties of the deposit, and the formation of fine-grained structure resulting in lattice distortion and internal stress, as an adsorption phenomenon. Co-deposited non-metallic impurities, such as hydrogen and oxygen, were also shown by Brenner to be present in the deposit. The source of the oxygen in the deposited nickel is considered to be the result of co-deposition of the colloidal nickel hydroxide, etc., probably present in the cathode film.

Co-deposited hydrogen is believed to be present as a result of the dissolution by the metal by hydrogen in the atomic state with possible penetration of the crystal lattice. Hydrogen may remain within the lattice in the atomic form or it may form a metallic hydride. Another possible source for the presence of hydrogen is the same as that attributed to oxygen. With diffusion of hydrogen or decomposition of the hydride, shrinkage occurs, resulting in contractile stress.

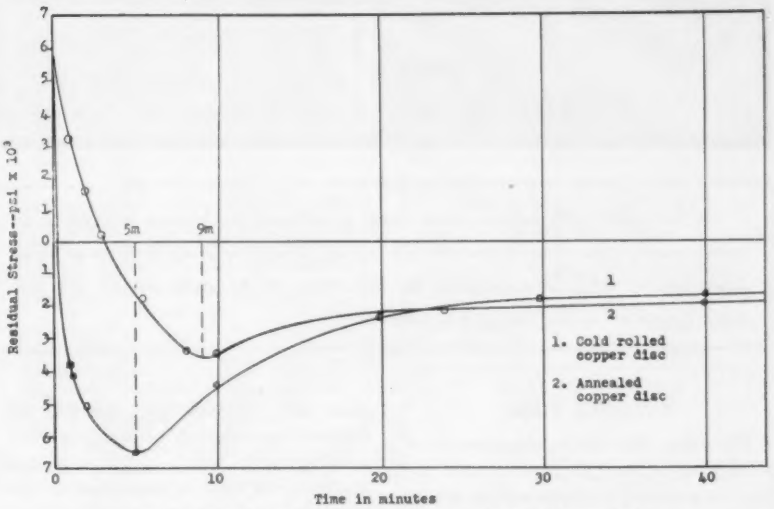


Fig. 9. Effect of stress reducing additive to nickel fluoborate bath.

Determination of the oxygen-hydrogen content was made by Brenner, by a vacuum fusion method. Results indicating an average oxygen-hydrogen ratio of 8 $\pm$ 2.6 were interpreted by Brenner as evidence that the two elements in the deposited metal are present in the ratio similar to that of water. This view is based upon the assumption that inclusions present are hydrous oxides, corresponding to the type $MO_x \cdot nH_2O$, with n greater than x, or that the oxygen and some of the hydrogen existing as hydroxyl groups, with sufficient free hydrogen present, may effect an 8:1 ratio by reduction. Mention is also made, by Brenner, that free water is not likely to be present in appreciable amounts, since moderate heat does not remove any.

A theory proposed by J. B. Kushner for the cause of residual stress in electrodeposited metals, based upon evidence gained in his development of the Stresometer, entails consideration of the following: An initial mechanism relates to lattice misfit in the first layers of the deposit, causing the depositing metal atoms to expand or contract the normal lattice structure, so that it will conform with the lattice of the basis metal — a mechanism, Kushner notes, that accounts for the high stresses in the first layer, 100-200Å of the deposit.

The second mechanism suggested is one in which water, present as an aquo complex, or present in the shell around the ion, may become attached parasitically to the metal atom at discontinuities or grain boundaries in the cathode structure. In support of this view, Kushner refers to the suggested conversion of the nickel aquo complex to the hydrated nickel oxide, $NiO_2 \cdot 2H_2O$, by hydrogen ions released from co-ordinated water molecules. Water (molecules) unconverted in this suggested process, and present parasitically in a strange lattice, diffuses out. The amount of water thus held at the lattice discontinuities and imperfections will affect the tensile strength and shrinkage.

This theory, Kushner contends, provides a satisfactory explanation for compressive stress obtained by the use of addition agents. For example, upon the addition of saccharin to a nickel solution, the characteristic high tensile stress, indicating lattice mismatch produced by the conformation of the atoms of the first few layers, becomes compressive as the saccharin, which is probably part of a complex cation, is also discharged and becomes attached to discontinuities and grain boundaries. The firm attachment of the contaminant is associated with probable compound formation; hence, less diffusion occurs than that which would occur with water molecules. The effect thus produced is comparable to a permanent wedge, resulting in a compressive force on the grains. This is shown in Fig. 9, in which nickel, from an unintentioned contaminant, believed to be saccharin, in a fluoborate bath, was plated upon a cold rolled copper disc and an annealed (1400°F., one hour) copper disc.

SHOP PROBLEMS



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gladly received and the sender's name will be kept confidential, if desired.

Stripping Films

Question: We are in the process of setting up a special plating unit for applying nickel deposits which are to be stripped after plating. In the phonograph record business, we understand that dichromate solutions are used to prevent adhesion of the deposit and believe that this type of stripping film would meet our requirements perfectly. Could you give us the details, if available?

T. M.

Answer: Your inquiry does not state the composition of the base to be plated. In the production of record stampers, the following stripping solution is used:

Potassium dichromate	3	g./l.
Borax	5	"

A nickel plated disc is immersed in the above for 1-3 minutes at room temperature and then rinsed prior to plating.

Cheap Rose Gold

Question: Your METAL FINISHING GUIDEBOOK-DIRECTORY section on antique gold plating gives two formulas for producing a smut but their use requires plating out too much gold for our cheap line. Our competitors must be using a cheaper method and we would appreciate any information you could send us on ways to produce this type of finish, particularly a rose gold, inexpensively.

R. J.

Answer: A smutting solution which does not contain gold is as follows:

Copper cyanide	3	oz./gal.
Sodium cyanide	4	"
Zinc cyanide	¾	"
Silver cyanide	1/10	"
Soda ash	3	"

The parts are plated in the above solution at room temperature and 6 volts, then the highlights are relieved, followed by a flash for color in a 24 kt. gold solution. Small amounts of lead acetate dissolved in caustic soda can be added to the smutting bath to darken the smut. Proprietary solutions are available from most suppliers of gold plating salts and solutions for producing smuts of various shades without the use of gold.

Pickling Inconel

Question: Can you please send us the composition of a pickle which will remove the scale from Inconel.

U. P.

Answer: Inconel may be descaled in the following pickle:

Nitric acid	1	gal.
48% Hydrofluoric acid	1¼	pints
Water	1	gal.

The scale is loosened by immersion at room temperature for periods of ¼ to 1½ hours, and can then be removed by scrubbing with pumice and water. If the above solution is diluted by addition of another gallon of water and the temperature raised to 150-165°F. the pickling rate is more rapid.

Silver Firing Paint

Question: I am interested in a silver paint or powder which can be applied to a glass surface to provide a base for subsequent electroplating. The paint must be absolutely adherent, such as the type used in the old days in the production of silver filigree on glassware. If you have any such formulas in your files, please forward and oblige.

A. G.

Answer: There are numerous formulations for this purpose. A good paint, with excellent adhesion is produced by addition of a fluoride, and the following is an example:

Silver powder	60	grams
Lead borate	3	"
Bismuth nitrate	1½	"
Lead fluoride	5½	"
Oil of lavender	30	"

The paint is applied and fired at 600-650 deg. C. After cooling and wet scratchbrushing, the silver film is ready for electroplating.

Bismuth Bath

Question: I would like to plate bismuth to a thickness of 0.002" on steel for a special purpose and could find in the literature only a solution containing perchloric acid. Because of the explosive hazard of this acid, I am unable to use this type of solution. Is there any other, more modern solution, which does not present this hazard, and which will produce a good plate in the required thickness?

I. D. C.

Answer: A chloride bath was patented by Beach in 1958 and assigned to the U. S. Government. When used at room temperature and a current density of about 30 amp./sq.ft. this bath will deposit 2 mils in a little over an hour. Periodic reverse current is required, with a ratio of 10½ seconds direct and 5 seconds reverse.

Bismuth chloride	100	g./l.
Sodium chloride	18.5	"
Hydrochloric acid	210	ml./l.

The steel should be nickel plated prior to bismuth plating.

Vienna Lime

Question: We have noticed, from time to time, references to cleaning with Vienna Lime Paste. Is this the same material as chalk or whiting?

N. C. L.

Answer: Vienna Lime is a dolomitic lime, high in magnesium oxide content, and is often used as a mild cleaner paste. Chalk can refer to two different materials. One is a natural form of calcium carbonate, and the other is a mineral containing 80-85% silica and 10-15% alumina, and is not a carbonate at all. Whiting is another name for chalk.

Descaling Beryllium Copper

Question: Enclosed is a sample of a heat treated beryllium copper stamping from which we are having difficulty removing the scale in preparation for plating.

These parts are cleaned and given the conventional nitric-sulfuric acid bright dip but, as you can see by the enclosed sample, the scale is not removed and the surface is badly pitted. What do you recommend for scale removal which will also give us a better surface for plating?

H. G. S.

Answer: It is necessary to remove the scale from beryllium copper prior to bright dipping, in order to avoid the pitting and etching you are experiencing.

It is suggested that the scale be removed by immersion in hot 10% by volume sulfuric acid, to which you can add 4 oz./gal. sodium or potassium dichromate, if desired. After descaling, the parts may be dipped in a solution of 1 volume nitric acid to 2 volumes water if a brighter finish is desired.

Plating on Titanium Alloy

Question: We have a problem involving plating of titanium alloy. The use of this metal is mandatory for its high strength. The galling tendency of titanium cannot be tolerated, and our solution to this problem is attempting to copper plate then silver plate.

From what literature we have surveyed, titanium presents difficulties in plating as regards adhesion. Can you furnish information that will insure good adhesion of the copper to titanium? Alloy composition is as follows:

13% vanadium
11% chromium
3% aluminum
Remainder titanium

W. H.

Answer: We have no references on methods of plating on this alloy; however, a procedure has been suggested by Missel for alloys containing 5% chromium and 3% aluminum, as follows:

1. Clean and descale, as usual.
2. Immerse for 1 minute at 210°F. in a solution of 100 g./l. sodium dichromate, 5 g./l. copper sulfate, and 50 ml./l. 52% hydrofluoric acid.
3. Rinse and plate.

Use of zinc sulfate instead of copper sulfate is stated to result in better adhesion.

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Coating Compositions

U. S. Patent 2,970,927. *Feb.* 7, 1961. *B. David.*

A composition for protectively coating metallic surfaces against the effects of high temperature consisting essentially of a homogeneous suspension in a liquid vehicle of colloidal graphite and at least one colloidal metal of low activity, said metal being selected from the group consisting of silver, gold and platinum, said liquid vehicle being selected from the group consisting of non-drying vegetable oils and mineral oils, wherein is contained between about 7.5 and 8 parts of graphite for each part of said metal.

Bright Copper Bath

U. S. Patent 2,970,951. *Feb.* 7, 1961. *J. W. Manquen and H. Brown, assignors to The Udylite Corp.*

A bath for electrodepositing bright ductile copper comprising an aqueous alkaline copper cyanide solution containing dissolved therein an acetylenic ether nitrile selected from the group consisting of 1-hydroxy-4-(beta cyanoethoxy) butyne-2 and 1,4-di-(beta cyanoethoxy) butyne-2 in an amount of from about 0.02 gram/liter to about 1.0 gram per liter.

Dual Spray Gun

U. S. Patent 2,971,700. *Feb.* 14, 1961. *D. J. Peeps, assignor to The DeVilbiss Co.*

A spray gun for spraying an article with a coating material formed of two liquid portions which react chemically when combined.

Chemical Polishing

U. S. Patent 2,971,826. *Feb.* 14, 1961. *C. C. Cohn and S. L. Cohn, assignors to Samuel L. Cohn and Charles O. Cohn.*

A method comprising the steps of immersing an article of aluminum or an alloy of aluminum in a bath comprising phosphoric acid, nitric acid and water having a brightening action on the surface of said article, withdrawing said article from said bath at substantially the time of completion of the desired extent of said chemical action, and treating said article immediately and while it carries adhering liquid from the bath with an aqueous solution of nitric acid adapted to stop further chemical action on the surface of the article.

Plating on Stainless Steel

U. S. Patent 2,973,307. *Feb.* 28, 1961. *E. A. Hahn, assignor to Lyon Incorporated.*

The method of preparing austenitic stainless steel for receiving a chromium plate, which consists essentially in subjecting said stainless steel to anodic cleaning in an alkaline bath containing an alkali metal salt selected from the group consisting of silicates and phosphates and having an alkalinity equivalent to from 10 to 16 oz./gal. of NaOH to remove grease and surface oxides, withdrawing said steel after a short period of time in the neighborhood of ½ to 2½ minutes, rinsing, dipping the steel in a dilute sulphuric acid bath and again rinsing before chromium plating said steel and without further processing said steel bright chromium plating the same.

Complex Plating Bath

U. S. Patent 2,973,308. *Feb.* 28, 1961. *K. E. Schimkus, assignor to Acme Steel Co.*

An electrolytic bath for forming coatings of metals on a base metal comprising a solution containing cations of a coating metal selected from the group consisting of copper, zinc, tin, nickel, cobalt, cadmium, tungsten, manganese and lead and alloys predominately of said metals, and complexing anions of a phosphoric acid ester of a cyclohexanol, said complexing anions being present in an amount sufficient to form a complex with a substantial amount of the coating metal cations present in the solution.

Flexible Abrasive Wheel

U. S. Patent 2,973,539. *Mar.* 7, 1961. *W. F. Buehrle.*

A buffing brush adapted to abrade a work piece comprising a plurality of abrading elements each having a supported end supported on a peripheral collar and a free end extending inwardly from said collar and terminating on a cylindrical surface providing a space for receiving a work piece; said abrading elements being equally distributed around the periphery of said collar and having their free ends bent all in a same predetermined direction.

Fluidized Bed Coating Process

U. S. Patent 2,974,059. *Mar.* 7, 1961. *E. Gemmer, assignor to Knapsack-Griesheim Aktiengesellschaft.*

The process of forming a layer of material on a surface of an article which comprises forming a fluidized bed consisting of a dense phase bounded by an upper free surface by passing a distributed ascending current of gas through a mass of resinous solid pulverulent layer-forming material containing particles therein which sinter when heated, immersing the article surface in said dense phase while said article is heated to a temperature below the deterioration temperature of the article but at least as high as the sintering temperature of said particles and at least as high as the transient degradation temperature of said particles, and cooling the article.

Fluidized Bed Coating Method

U. S. Patent 2,974,060. *Mar.* 7, 1961. *C. J. Dettling, assignor to The Polymer Corp.*

The process of coating an article having sections of different heat capacity in the ratio of at least 2 to 1, comprising heating the article, immersing the article while it is heated in the dense phase of a fluidized bed of pulverulent fusible coating material, the heating temperature being sufficient to maintain said section of lower heat capacity above the sintering temperature of the coating material but low enough that on subsequent withdrawal from the fluidized bed a powdery, incompletely fused layer of coating material is produced thereon, maintaining said article in said dense phase for a time sufficient to produce a coating on both of said sections, thereafter withdrawing the article from the fluidized

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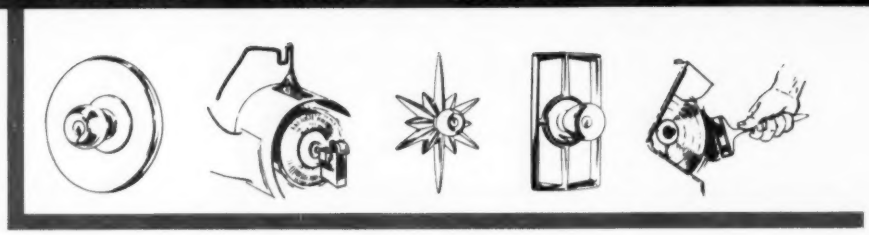
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LEABRAMENT — greaseless, non-flammable, quick-drying, liquid abrasive for burring and polishing; can be sprayed or brushed on wheels.

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LEAROK — fine abrasive compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations.

LEA LIQUABRADE — clean-working, fast-cutting and mirror-finishing liquid buffing compounds, providing in effect continuous operations and substantial economies in compositions and buffs; clean and safe, non-flammable, non-explosive; many abrasive types and grain sizes for all non-ferrous metals, steel, stainless alloys, and plastics.

LEA LAPPING PASTE — micron size controlled abrasive paste for accurate and fine surface finishing.

LEA LINT-OFF — an anti-static solution for neutralizing static charges on plastics and other non-metallic surfaces.

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AD-LEA-SIVE — glue-base adhesive for sizing buffing and polishing wheels to improve application of Lea Compound, or loose abrasives; available in bar form.

LEA PLASTI-GLUE — fast-drying, flexible liquid adhesive, without abrasives, for preparing polishing wheels and abrasive belts.

LEA GRIPMASTER — high bonding strength cement for polishing wheels and belts; used in setting up longer lasting polishing wheels and belts for both ferrous and non-ferrous metals.

POLISHING WHEEL and BELT LUBRICANTS

LEA LIQUALUBE — water soluble liquid lubricant for polishing wheels and belts; can be sprayed or brushed on.

LEA LUBAR — bar form lubricant for polishing wheels and belts where glazing is not a problem.

cLEAn GRAIN LUBAR — special bar form lubricant to eliminate glazing on polishing wheels and belts.

BRIGHT PLATING PROCESSES and ADDITIVES

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COMPANION PROCESSES:

Q-STRIKE
Q-LEVEL
CUPRALL

See Lea-Ronal ad for details of these processes.

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LEA ANALYTICAL METHODS — plater's short cut methods for analyzing plating solutions.

LEA LECTROMAG — portable electrical instrument for measuring the thickness of non-magnetic coatings on carbon steel and iron.

LEA KROMSAVERS — mist preventive for chrome and other plating solutions.

LEATARDENT — anti-stain dip emulsion; prevents staining and tarnishing of plated surfaces.

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PRECIOUS METAL PROCESSES — GOLD

AURO GLO 4 — an acid type bright ductile, easily controlled gold process; designed for electronic and allied uses. Hard, porosity free bright deposits.

AURALL — an all-inclusive lustrous 24K acid gold bath, for the electronic and allied industries; simple to operate, stable process; excellent substitute for cyanide gold.

AURO GLO 12 — a modification of Auro Glo 4 where hardness of 350-400 Knoop is desired. Produces hamilton colored shade, ideal for jewelry and allied uses.

AURO GLO HS — a neutral, zero free cyanide, bright high speed process. Rates of Deposition of 0.003" per hour readily obtained from a low concentration bath.

AURO GLEAM 24.00 — an entirely different acid type bath producing 100% pure bright gold deposits —no alloying elements.

PRECIOUS METAL PROCESSES — SILVER

BRIGHT SILVER — produces bright, hard tarnish-resistant deposits at high rates of speed from crystal clear solution. For industrial or decorative uses.

NICKEL PLATING PROCESSES

NICKEL GLEAM N-222 — ductile deposits, with exceptional leveling characteristics, high throwing and covering power. Same solution operates with air or mechanical agitation.

UNIGLEAM A & UNIGLEAM S — radically different single brightener type bright nickel process for still, mechanical, or air agitation operations; simple to operate; produces brilliant ductile highly leveled deposits (A—air agitated; S—still tank).

NICKEL-GLO BBN — a hot, bright nickel barrel process, producing brilliant deposits at high speed.

NICKEL GLEAM N-1 — bright all-purpose type of bath, exceptional tolerance to impurities, very active nickel surface. A true work-horse nickel bath.

NIKAL PC — a low stress high speed nickel solution designed for printed circuitry and other electronic uses.

CYANIDE PLATING PROCESS

COPPER-GLO — Bright copper — a proved brilliant high speed bath exceptionally tolerant to impurities.

CUPRALL — produces high speed buffable copper where brilliance is not required.

Q-LEVEL — a high speed lustrous copper process, produces excellent "hiding" characteristics. An ideal undercoat for bright nickel. Simple to operate and control. Uses one brightener.

AIR Q-LEVEL — Q-Level process designed for operation with periodic reverse current.

Q-STRIKE — a cyanide copper strike that produces a superior foundation for subsequent copper and nickel deposits.

CYANIDE COPPER ADDITION AGENTS: — usable with any type cyanide copper.

CW-7 WETTING AGENT — a wetting agent with high degree of stability. Increases tolerance of bath to organic contamination; benefits anode corrosion.

SUPERTARTRAL — exceptionally effective addition agent for cyanide copper baths; aids anode corrosion; reduces cyanide breakdown.

LR-1 — chrome reducer. Particularly effective in copper strikes and plating baths where chromium contamination is high.

TST — a purifier for all copper baths and strikes contaminated with zinc and chromium.

ACID COPPER PROCESSES

CUPROTYPE — smooth, tree-free heavy deposits at high speed. Proved for electronic use, (printed circuitry etc.) electrotyping, electroforming, etc.

COPPER GLEAM — brilliant deposits with exceptional leveling characteristics.

BRASS PLATING PROCESSES

BRASS-GLO — high speed brass process for still tanks well proved after several years operations in numerous plants. Uniform lustrous deposits over wide range of current densities with high cathode efficiencies.

BRASS-GLEAM— high speed brass process for barrels. Uniform brass colored deposits; wide range of current densities at high cathode efficiencies.

BRASS FLASH — additive for standard low temperature brass solutions where thin flash deposits are plated, for example, over bright nickel. Uniform stable color over wider current density range than with conventional brass baths.

ZINC PLATING PROCESS

BRIGHT ZINC — for barrel and still tank operation. Stable brighteners with long staying power.

CADMIUM PLATING PROCESS

BRIGHT CADMIUM — a bright protective cadmium electrodeposit for use on both ferrous and non-ferrous metals.

RINSES, ANTI-TARNISH, DRYERS, INSTRUMENTS, ANALYSES, ETC.

WATERSHED — liquid rinse aid which promotes free rinsing and fast drying; reduces staining and spotting of plated pieces.

CHROMESHED — a powdered water soluble material which reduces and ties up hexavalent chromium in rinse tanks and cleaners.

DRYER WDL-1 — a water displacing liquid which offers a simple economical means of drying plated work.

NOTARN "EC" — an anti tarnish treatment for solid and electroplated copper, brass, and grossly increases tarnish resistance, reduces spotting out.

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bed, cooling all portions of the article to a temperature sufficiently below the melting point of the coating material to produce a hardened coating and thereafter heating said incompletely fused layer to a temperature above the melting point of the coating material.

Method of Reducing Eye Holing in Lacquered Tin-Plate

U. S. Patent 2,974,091. *Mar.* 7, 1961. *R. A. Neish, assignor to U. S. Steel Corp.*

A method of making tin plate which consists in electrodepositing a coating of tin on a sheet-steel base, forming a protective film containing chromium compounds and at least a residual amount of free hexavalent chromium over the tin coating and then treating the tin plate with an aqueous solution containing from .2 to 1% of a reducing agent effective to reduce any free hexavalent chromium thereon to trivalent chromium.

Electrolytic Means for Treating Metal

U. S. Patent 2,974,097. *Mar.* 7, 1961. *E. R. Ramirez and E. F. Barkman, assignors to Reynolds Metals Co.*

Apparatus for the electrolytic treatment of the edge portions of a flexible metal web comprising a hollow vessel for containing electrolyte, means for supplying electrolyte to and removing it from said vessel, means for guiding said metal web through the electrolyte comprising a pair of opposing ribs terminating in flat faces spaced apart to permit passage of the metal web between them, stationary resilient sealing means mounted in said ribs extending toward and longitudinally of said metal web and adapted to maintain contact with the metal web near the edge portions thereof to confine the action of the electrolyte to said edge portions, and at least one electrode mounted in the interior of said vessel opposite the line of passage of said metal web, and means for conducting electric current to said electrode and to the metal web.

Hot Spray System

U. S. Patent 2,974,874. *Mar.* 14, 1961. *P. Raymond, assignor to Protectal.*

In a sprayer, in combination, wall means defining a hollow elongated enclosure having opposite closed ends and respectively formed adjacent said ends with an inlet leading into and an outlet leading out of said enclosure; a container adapted to contain material to be sprayed, said container being substantially larger than and containing said enclosure with the material in the container contacting the exterior surface of said wall means; fluid supply means communicating with said inlet and supplying a fluid to said enclosure in direct contact with said wall means, the fluid flowing through the interior of said enclosure from said inlet to said outlet thereof; heating means located in said enclosure for heating the fluid flowing therethrough so that heat will be transferred from the heated fluid through said wall means to the interior of the container to heat material in the latter; nozzle means communicating with said outlet so that the heated fluid flows from said outlet through said nozzle means; and conduit means leading from the interior of the container to said nozzle means for directing material from the interior of the container to said nozzle means to be sprayed from the latter with the heated fluid.

Pickling Waste Recovery

U. S. Patent 2,975,029. *Mar.* 14, 1961. *J. B. Horton and E. J. Serfass, assignors to Bethlehem Steel Co.*

The method of reclaiming acid from an aqueous solution of a free mineral acid of the group consisting of sulfuric, phosphoric, nitric, hydrofluoric and hydrochloric and an iron salt which comprises bringing said solution into reactive contact with the hydrogen form of a cation exchange resin and thereby removing iron from solution in the form of an iron-bearing resin and forming additional free acid, then treating the iron-bearing resin with concentrated sulfuric acid having a strength ranging from 55% to 96%, and thereby regenerating said resin and precipitating ferrous sulfate, said concentrated acid having a specific gravity greater than the specific gravity of the regenerated resin and less than the specific gravity of the precipitated ferrous sulfate.

Etching Aluminum

U. S. Patent 2,975,039-40. *Mar.* 14, 1961. *R. H. Elliott, Jr., assignor to Pennsalt Chemicals Corp.*

The method of etching aluminum including aluminum base alloys involving relatively rapid solution of substantial quantities of said aluminum in a hot aqueous solution of an etching alkali, said method comprising treating the surface of said aluminum with an aqueous solution containing from 1 to 20% by weight of an etching alkali and containing at least one metal ion of the group consisting of hexavalent molybdenum, divalent nickel, divalent iron and trivalent iron at a temperature of from 120° to 212°F., said metal ion being present in an amount of at least 0.2% by weight based on the weight of said alkali.

Etching Aluminum

U. S. Patent 2,975,041. *Mar.* 14, 1961. *E. R. Holman, assignor to Purex Corp., Ltd.*

A method of etching aluminum comprising, contacting aluminum with a solution containing free alkali metal hydroxide at a relatively high temperature to react the aluminum with said alkali metal hydroxide and form alkali metal aluminate in a first zone without producing any substantial amount of solid hydrated alumina therein, removing the resultant solution to a second zone, cooling said removed solution in said second zone in the presence of solid hydrated alumina to precipitate an additional quantity of solid hydrated alumina therefrom and increase the quantity of free alkali metal hydroxide therein, separating the precipitated hydrated alumina from the solution, and returning the solution to the first zone.

Electroless Nickel

U. S. Patent 2,975,073. *Mar.* 14, 1961. *H. K. De Long and D. R. Ritzema, assignors to The Dow Chemical Co.*

The method of increasing the corrosion resistance of nickel plate chemically deposited from an aqueous solution containing nickel and hypophosphite ions at a pH of between 3.5 and 7 on a magnesium-base alloy article immersed therein which comprises thereafter immersing the thus nickel-plated metal magnesium-base alloy article in an aqueous solution having a pH between 0.5 and 5 and containing a chromium compound selected from the class consisting of chromic acid and sodium dichromate, said chromic acid being employed in an amount between 0.1 and 5 per cent and said sodium dichromate between 5 and 15 per cent by weight of the bath.

Vitreous Enamel for Aluminum

U. S. Patent 2,975,070. *Mar.* 14, 1961. *B. C. Bricker and L. C. Hoffman, assignors to E. I. du Pont de Nemours.*

A vitreous enamel frit, suitable for use as a protective coating on the surface of aluminum and aluminum-rich alloys, having a firing and maturing temperature below 1,000°F., said frit consisting of the following, in mole percentages:

	Per cent
PbO	6.2
SiO_2	36.3
TiO_2	19.5
Na_2O	23.4
Li_2O	5.6
K_2O	4.8
Sb_2O_3	0.6
B_2O_3	0.1
BaO	3.5

all of said oxides being melted into said enamel composition.

Vacuum Metalizing

U. S. Patent 2,975,075. *Mar.* 14, 1961. *N. C. Beese, assignor to the United States of America.*

The method of producing coatings by evaporation of silver or gold from a filament selected from the group consisting of tungsten and molybdenum comprising applying to said filament a mixture comprising silicon powder dispersed in an organic binder, heating said applied filament in an evacuated atmosphere to volatilize said binder and to cause a coating of silicon to remain upon the surface of said filament, heating a metal selected from the group consisting of silver and gold on said coated filament in a high vacuum whereby said selected metal melts and wets said underlying coated filament and thereafter evaporates onto the surface being coated.

Coloring Anodized Aluminum

U. S. Patent 2,975,081. *Mar.* 14, 1961. *B. H. Kirby, Jr., V. T. Humphreys and T. James, assignors to Koppers Co.*

Method of coloring oxide-coated aluminum comprising applying a coloring solution of at least 0.01 per cent by weight of an organic water-insoluble colorant dissolved in a liquid substantially water-immiscible aromatic solvent having a boiling point of at least about 80°C. to aluminum having an artificially produced oxide coating thereon at a temperature between ambient temperature and the boiling point of said solvent.

FOREIGN LITERATURE

Plating Turned Steel Components

W. Roggendorf: *Galvanotechnik*, **6**, No. 47, 272.

Certain difficulties may be encountered under some circumstances in plating of free-cutting steels, if certain precautions are not taken. These steels may contain either lead or sulfur to facilitate machining on automatic lathes, etc. It is known from experience that the lead-bearing steels are quite unsuitable for any type of electrochemical surface treatment because marked corrosion and surface roughening can occur during treatment. Possible troubles to be encountered can be reduced if the following precautions are taken. It is important to ensure that, if cathodic cleaning baths are used, they contain no metasilicate. Otherwise, silicate films can very easily be formed on the ware, and these are then extremely difficult to remove.

For neutralization of the alkali film arising from alkaline cleaning, it is best to use a 2 to 3% sulfuric acid solution or a 0.5 — 1% solution of tartaric acid, at 20°C. A thorough rinsing should again be given after neutralization. Before copper plating, it is an advantage to dip in 5% sodium cyanide solution, and the ware should be immediately passed into the hot copper-plating bath with current-on.

Anodic cleaning should not be employed with free-cutting steels. The simultaneous cleaning-coppering process also should not be used with these steels.

Drag-Out Losses and Plating Costs

W. Peters: *Galvanotechnik*, **47**, No. 6, 262.

The author gives two examples of the drag-out losses occurring with bright-zinc and bright chromium plating baths and the influence of these losses on the plating costs.

An estimate was made of the drag-out losses per 1,000 radio chassis being treated. Two tanks, each filled with 200 liters, were used for the first and second rinse after zinc plating. After 1,000 chassis had been passed through the bath, titration of the rinse water gave the following cyanide content — 1st. rinse water: 6.8 g./l. sodium cyanide; 2nd. rinse water: 1.1 g./l. Thus the total amount of the drag-out was 200 x 6.8 + 200 x 1.1=1,580 grams. With a cyanide content of the zinc bath of 80 g./l., the equivalent of about 20 liters of electrolyte had been dragged out, which amounts to about 20 cc. per radio chassis being treated. With the electrolyte cost-figure of 1 German Mark per liter, the drag-out losses for 1,000 chassis amount to about 20 Marks without reckoning the detoxification costs for the liquor wastes.

With an estimated surface of 40 dm^2, a coating thickness of 8 microns and a zinc anode price of 2 Marks/kg., the plated metal price for the deposit amounts to 46 Marks per 1,000 chassis. If the electrolyte loss into the first rinse tank, is again filled-back into the plating tank, then a part of the electrolyte lost can be recovered. This amount however, is lower than is generally accepted because, if the concentration in this feed-back rinse tank rises, the drag-out losses to the next rinse stage rise. With cold baths, a reduction of 20% of the drag-out losses can be obtained by feed-back. Warm or hot electrolytes, in which the evaporation losses are high, require greater amounts of make-up water. This, taken from the first rinsing tank, can lead to a reduction in the drag-out loss of up to 60%.

A second example is given of the calculation of the drag-out losses in bright chromium-plating of bumper-bar side-guards. Again, 1,000 of these components were plated under normal conditions. The bath had a chromic acid content of 400 g./l. After throughput of these 1,000 parts, there was present in the first rinsing tank a chromic acid content of 8 g./l. and, in the second rinsing tank, 1.8 g./l. The total dragout was thus 200 x 8 + 200 x 1.8 = 1,960 grams, equivalent to 4.9 liters of bath. The drag-out from the second to the third rinsing tank was not considered.

With an estimated surface area of 5 $dm.^2$ per part, and a chromium coating thickness of 0.5 microns, about 4 kg. of chromic acid are used for electrolysis plus drag-out losses. Accordingly, the drag-out losses amount to about 50%. The suction losses for the tank venting must also be taken into consideration.



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Anti-Tarnish Process

Lea-Ronal Inc., Dept. MF, 130-19 180th St., Jamaica 34, N. Y.

No-Tarn "EC" is claimed to impart high tarnish resistance to non-ferrous metals, such as electroplated brass, copper, as well as solid brass, and other copper-base alloys. Work that is electroplated in cyanide solutions has a tendency to stain and spot out. When such plated parts are treated, entrapped cyanide is neutralized and spotting out materially reduced, it is stated.

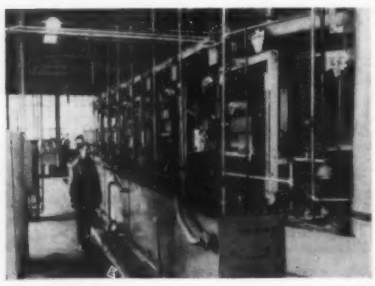
The material is a dry salt mixture that is used in an aqueous solution with electric current. It is simple to make up, use and control. It is marketed in standard type containers in 50, 100, and 500 pound lots. Special quantities on request.

Automatic Barrel Plater

Udylite Corp., Dept. MF, Detroit 11, Mich.

The new VIP (variable, integrated, processing) is a versatile plating machine with a built-in "brain." The focal point is a central control panel from which a variety of transfers, delayed dips, barrel rotations, dwell periods and power can be programmed to meet most plating requirements currently in demand. Although the entire plating operation is normally controlled by one man through operation of the central panel, each barrel and carriage assembly containing parts that are being plated may be controlled separately, if such is required by the production schedule.

Uniformly good coverage and thickness of the deposit on the work consistently is obtained because of controlled automatic cycling. The "brain" may also regulate the amount of time each perforated barrel rotates over a tank, providing increased drainage, hence, decreased contamination of the succeeding solutions.



The heart of the machine's unique design is the combination of a motor, an over-running clutch and a self-locking type of speed reducer. When a barrel revolves in the "down" position, the clutch over-rides (like free-wheeling on a bicycle). However, when the motor is reversed, the clutch grips its shaft, and elevates the barrel.

Each barrel has an individual, dual purpose electric motor which rotates the barrel and also elevates it for horizontal transfer. Barrels descend by gravity, although the rate of descent is controlled by the motor drive.

Each barrel may be left in the "up" position indefinitely. During a trial or limited run, any number of barrels may be set to go around the machine in the "up" position, eliminating storage requirements and excess handling while work is put in the one barrel only.

Multiple indexing permits the central control panel to program barrels through the processing and plating tanks at different rates of speed, keeping the plating tank full at all times. This feature eliminates the necessity of having a barrel at every station of the machine.

Lead Alloy Anode

Heil Process Equip. Corp., Dept. MF, 12850 Elmwood Ave., Cleveland 11, Ohio.

These new HS-32 anodes are manufactured of a new, special lead alloy developed specially for use with high fluoride-ion plating solutions. They have been tested thoroughly in actual operation, and have been approved by manufacturers of the fluoride-ion plating solutions for use with these new solutions. In addition to their many other advantages, these anodes have superior current conduction properties after idle or shut-down periods. Available in four round diameter sizes and any desired length.



Emulsifiable Rust Preventive

Magnus Chem. Co., Dept. MF, Garwood, N. J.

A low-cost, water-compatible, nonflammable rust preventive that can be applied directly to dry surfaces or to surfaces wet with water or with soluble cutting oil emulsions, Magnafilm 230 furnishes excellent indoor protection, eliminates the fire hazard often associated with solvent-cutback rust preventives, removes corrosive fingerprints and, in addition, provides protection against fingerprint damage during subsequent handling.

The thin, transparent, polar film does not interfere with visual inspection or impair the legibility of identifying marks. However, if discernability of the film is of importance, a dye can be added. In unusual cases, when the film must be removed before protected parts or assemblies are put into use, it



"By plating this part with LEVELUME 220 we slashed polishing time in half"

says JOSEPH T. HINES, Plant Manager, Southern Finishers, Inc., Nashville, Tenn.

A 50% reduction in the time it takes to polish this griddle cover is only *one* of the reasons Southern Finishers, Inc., is so enthusiastic about Levelume 220. This plater of some 500 different parts has cut polishing time one-quarter in *over-all* operations. Copper plating and copper buffing have been done away with on the griddle part and many others—saving up to two steps in seven.

"Appearance is better, too," says Joe Hines, a plater for 16 years. "Levelume 220 hides scratches nicely, plates brighter in recessed areas than any bath I've ever seen."

Southern is plating parts from ½-inch faucet buttons to 64" x 25" wire racks. What will Levelume 220 do on what *you're* plating? Ask H-VW-M.

H-VW-M *Progress in metalfinishing through advanced processes • equipment*

Hanson-Van Winkle-Munning Company, Matawan, New Jersey • Offices in Principal Cities
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is easily accomplished by the use of mineral spirits.

Normal protection requires seven parts of water to one part of rust preventive but, in many cases, a 9:1 water/oil ratio may be sufficient. In extremely severe conditions, a 5:1 ratio of water and rust preventive may be required. When mixed at the normal water/oil ratio of 7 to 1, the cost of the emulsion is only about 45c per gallon (enough to coat 4,400 square feet of polished steel surface when dipped at room temperature).

The material conforms to Military Specification MIL-C-40084 (ORD) covering "Corrosion Preventive Compound, Water-Emulsifiable, Oil Type."

Coating Thickness Tester

Twin City Testing Corp., Dept. MF, P.O. Box 95, Tonawanda, N. Y.

A non-destructive, compact coating gauge, the Permascope Model EC2T4 has three main uses: measurement of thicknesses of non-conductive coatings, thicknesses of non-ferrous metal coatings on non-ferrous-base metals, and conductivity of non-ferrous metals.

Basic theory involves the eddy currents found in metal. The metal surface is subjected to an electromagnetic field and, by measuring changes caused by the eddy currents, coating depth can be measured rapidly and precisely.

The instrument has been specifically calibrated to gauge non-conductive



coatings, but can be altered to measure metal coatings on substrates. With minor modifications, the unit can be used for conductivity tests. Calibrations are also available for other metals.

The instrument has a minimum number of components and is quite stable in operation. Either 110 or 200 volts alternating current may be used with the gauge.

Anti-Tarnish Compound

Frederick Gumm Chem. Co., Inc., Dept. MF, 538 Forest St., Kearny, N. J.

Tarnishing of brass, copper and silver, as well as plated deposits of these same metals can be completely eliminated by the use of Clepo 170 anti-tarnish compound. A short immersion is claimed to provide a colorless film which will resist the attack of oxygen and sulfur compounds for periods ranging from 6 to 12 months, depending upon the local atmospheric conditions. Spotting out is similarly eliminated and lacquer coatings will have improved adhesion when applied after treatment in the anti-tarnish compound. This simple effective process is inexpensive to operate and requires no special tank linings.

Stainless Steel Bright Dip

Diversey Corp., Dept. MF, 212 W. Monroe St., Chicago 6, Ill.

The new DS-9 bright dip process for polishing and descaling stainless steels of the AISI-300 series by means of simple chemical immersion, is stated tc produce uniform specular finishes. In many cases, satisfactory descaling and moderate brightening can also be achieved on other series of stainless steel.

The process effectively removes heat-treat scale and welding scale. Silver and brass solder are not affected by immersion in the bright dip solution. A minimum loss of metal occurs when

series 300 stainless steel is processed. This is particularly important when close tolerances must be maintained. In a standard brightening process, for example, tests have shown a maximum loss of 0.5 mil per side on panels of 302 stainless steel with 2B finish.

Metal Activator

Dura-Brite Chemical Products, Inc., Dept. MF, P.O. Box 82, Farmingdale, L. I., N. Y.

The above firm announces the availability of an activator that is claimed to permit plating nickel on nickel without blistering. It is non-fuming, provides a perfect bond, and will activate nickel before chromium plating.

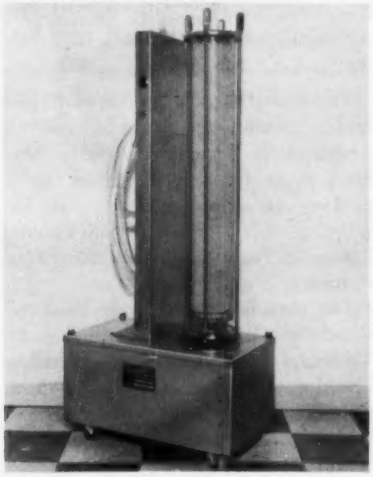
Other advantages of the activator, according to the manufacturer, are: it dissolves oxide formed on any basis or plated metal; it removes rust from cast iron or steel; it eliminates handling strong acids; and also eliminates heating problems. Samples will be treated free of charge to demonstrate the superiority of the process.

Gold Recovery Unit

Technic, Inc., Dept. MF. P.O. Box 965, Providence, R. I.

A new Gold Saver will recover cyanide or alkaline gold which, up to now, has been lost in the conventional plating process. The unit traps between 100 and 125 troy ounces of gold for each resin charge.

In operation, the device is placed beside the first or second dragout tank with inlet and outlet hoses placed in the tank. When started, the unit circulates the dragout solution through the resin column, which, by ion exchange, recovers the gold previously lost. When the resin is saturated with gold, its color changes. The resin is then removed, sent to a refiner for recovery, and the column may be recharged with fresh resin.



Bright Zinc and Cadmium Processes

Kosmos Electro-Finishing Research, Inc., Dept. MF, 140 Liberty St., Hackensack, N. J.

The above firm announces the availability of three new coatings. Zin-K-Lux-D is a brightener for cyanide zinc plating, which is said to produce lustrous plate right out of the bath. It has excellent throwing power, is adaptable for both still and barrel plating, and has excellent life in bath.

Cadlux-D, a cadmium plating brightener, has maximum throwing power and uniform brilliance for both barrel and still plating.

Ker-Chro-Mite 5 is a single step chromate bright dip for zinc or cadmium, supplied in concentrated form. It is said to produce a lustrous finish in a single dip and to have excellent life.

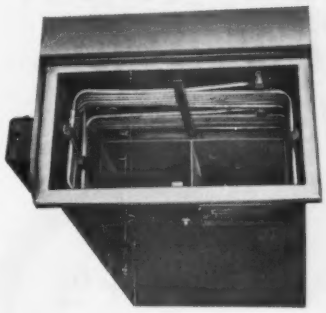
Miniature Filter Systems

Sethco Mfg. Corp., Dept. MF, 2284 Babylon Turnpike, Merrick, L. I., N. Y.

The Model LAI-1 shown in the photo combines the miniature "Full-View" lucite filter chamber with a miniature epoxy centrifugal pump. Powered by a 1/40 hp continuous duty motor, all the components are mounted

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TRISEC®
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Finally . . . a solvent dryer that really works!

STAIN-FREE drying of metal parts after aqueous washing and rinsing . . . Ideal for spotless drying of polished articles and metal parts after electroplating, phosphating, chromating, electropolishing, contour etching, acid pickling, bright dipping and alkaline derusting.

This new patented "TRISEC" process provides rapid, thorough, stain-free drying of water-wet metal parts at low cost. The process is suitable for practically all articles, including glass, ceramics and metals. It can be used for intricately shaped parts with cracks and crevices as well as stampings, extrusions, castings, tubes, wire and strip.

The "TRISEC" process has been designed to replace conventional systems such as ovens, sawdust and maize, centrifuges, hot and cold blast dryers and perchlorethylene dryers.

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Bulletin 24

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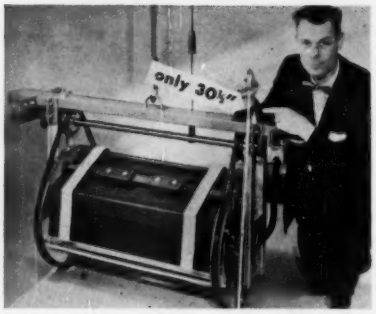
on an 8″ x 9″ linen phenolic panel. Since it comes complete with filter tube, vinyl hose and electric cord, it can be plugged into any 2 or 3 wire 110 volt A.C. outlet for immediate operation. Capacity is 180 G.P.H. on open pumping and this model will readily keep a ten gallon tank vigorously agitated or filtered to sparkling clarity.



Plating Barrel Superstructure

Singleton Co., Dept. MF, 11770 Berea Road, Cleveland 11, Ohio.

An overall measurement of only 30½″ from top of U-bolt hoisting fixture to bottom of cylinder makes "Low-Boy" the most closely-coupled superstructure by 2″ to 7″. Drive belts are shorter, and vertical hoist movements are reduced as much as 18″ per station for speeding manual operations, minimizing hoist time and manhours. Its lower in-tank silhouette extends above top of tank only 7½″, permitting lower level horizontal movements over barrels in stations without usual danger of collisions, etc.



All superstructures are built to operate in all solutions, acid or alkali. Hanger arms are coated with a special-formulation plastisol offering higher chemical, thermal and physical resistance than any others in the field. Cogged-V-Belt drive pulleys are H-T Plexiglas with Polydur cog-pins. Belts are Neoprene.

In-Process Protective Coating

Guard Coatings Corp., Dept. MF, 8-05 43rd Ave., Long Island City 1, N. Y.

Washguard plastic envelopes can be applied for as low as ⅛ cent per square foot of surface, and will protect metal even during such operations of roll form deep drawing and bending, it is claimed.

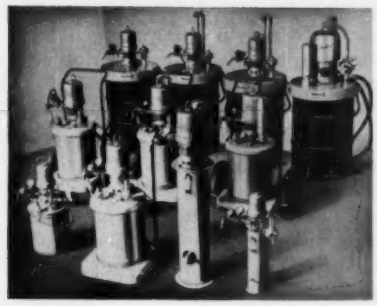
The products are liquid plastics designed to be applied by means of spray, roller coater, or dip to sensitive surfaces. Depending upon the type, removal is by water, alkaline wash or solvent wash. Or, in many cases these coatings can be used as final finishes or as shipping protection that the ultimate consumer may remove.

Airless Spray Equipment

Gray Co., Inc., Dept. MF, 1062 Sibley St. N.E., Minneapolis 13, Minn.

The new Hydra-Spray line of airless spray equipment includes eleven models, both portable and stationary. Sizes range from one 5-gallon model to four 10-gallon models, four 55-gallon models and two Hydra-Stands, airless spraying units for circulating systems.

The 5-gallon Monark is designed for direct spray from original 1 to 5-gallon containers. The 10-gallon President models are available with or without elevator, three-wheel truck, surge tank or filter. All work from original 1 to 10-gallon containers and



handle one or two-gun operations with ease.

Stationary 55-gallon models utilize President or Bulldog pumps and are designed for multiple gun, high speed application of material. The Hydra-Stand units may be obtained with either pump to incorporate the application process in a sealed standpipe unit for use with circulating systems. Material is kept circulating and only drawn into the unit as it is used.

Accessories include an improved automatic spray gun for fixed mounting and automated operation, and the new "Golden" hand gun, which has better balance and maneuverability. Both guns have pop-action valve for immediate, precise spray patterns. Other accessories include a variety of tips to handle almost any viscosity material. Included are fine finish tips for lacquer, varnishes and other fine interior finishes. All tips fit pole guns for hard-to-reach applications.

Colorless Clear Metal Coating

Universal Paint & Varnish, Inc., Dept. MF, Bedford, Ohio.

A new water-white, extremely clear protective finish for chrome, silver, brass, aluminum, zinc, steel and other metals, Universatile No. 8058 has exceptionally good adhesion and toughness. It can be air or bake-dried to a hard, high-gloss finish. Low in cost, it requires no expensive reducing solvents, and possesses excellent chemical resistance.

Strippable Coating

Guard Coatings Corp., Dept. MF, 8-05 43rd Ave., Long Island City 1, N. Y.

Washguard provides low-cost protection during metal fabrication. The plastic envelopes can be applied for as low as ⅛ cent per square foot of surface, and will protect metal even during such operations as roll-form deep drawing and bending.

Here's the
PHOSPHATE COATING
You asked **TURCO TO MAKE**

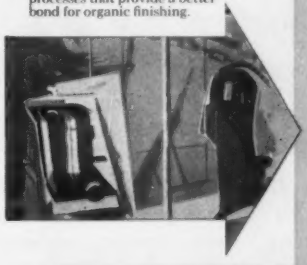
HERE'S HOW PAINTITE® SCORES ON SURVEY'S 12 "MOST WANTED" FEATURES...

—Formulated as Result of Industry-Wide Survey...

During the first six months of 1959, Turco undertook an extensive survey of the phosphate coating market. Hundreds of users of these coatings were interviewed. Thousands of questions were asked. When the answers were tabulated, Turco began the task of building an iron phosphate process to the *exact specifications* called out in the survey.

The new process is now available. It is called Turco Pair tite. Paintite has been thoroughly field-tested in the production lines of a dozen Turco customers. It has passed the most severe tests with flying colors. Turco is proud to announce the addition of Paintite to its ten other Turcoat phosphate and conversion coating processes that provide a better bond for organic finishing.

1. **SUPERIOR CLEANING**–Exclusive wetting system provides heavy-duty uniform cleaning. Cleans & phosphates simultaneously.
2. **TEMPERATURE VERSATILITY** – Efficient anywhere within range of 140° to 180°F. Temperature control is not important.
3. **LOW FOAMING** – at any temperature within recommended range.
4. **LESS POST RUST** – Eliminates post rusting problem often encountered with iron phosphate processes.
5. **NO WHITE STREAKING** – Extra free rinsing. Leaves no residue.
6. **ECONOMICAL**–Low in initial cost. Low in maintenance cost. Low in cost per sq. ft. Long-lived, even under mass production use.
7. **UNIFORM COATING** – even on edges and points. Won't show through on low-pigmented paints.
8. **USE VERSATILITY** – used by immersion, spray washer or steam cleaner.
9. **LESS SLUDGE** – less scale. Minimizes clean-up problems.
10. **RESERVE ACIDITY** – combats alkaline water conditions. Constant control not necessary.
11. **SUPERIOR SERVICE** – by Turco's vast network of technically trained servicemen, located in industrial centers throughout the world.
12. **REQUIRES ONLY 3 STAGES** – for dip or spray washing. Can be efficiently used in 5-stage operations, if desired.





FREE! VALUABLE BOOKLET
PHOSPHATING REFERENCE CHART
TECHNICAL DATA BULLETIN

Get the full story on Paintite and the other ten phosphating and conversion coating processes in the complete Turcoat line. Write for your copy, along with Turco's Phosphating Reference Chart, today!



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Offices in All Principal Cities

The material is a liquid plastic, designed to be applied by means of spray, roller coater, or dip. Depending upon the type of coating, removal is by water, alkaline wash, or solvent wash. Or, in many cases, these coatings can be used as final finishes or as shipping protection that the ultimate consumer may remove.

Periodic Current Reverser

Ramm Rectifier Co., Inc., Dept. MF, 527 Faile St., Bronx 59, N. Y.

Model R.C.T. periodic reverser is claimed to offer the utility of two pieces of equipment in one. It is not only a simply-operated, direct current reverser but, at the flip of a switch, it also becomes a direct current interrupter.

The reverser operates from a 115 volts source, is available in ranges from 0-100 amperes, and is constructed to sustain overloads for protracted periods of time. Also incorporated in this model is the "Ramm Lite" which



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EQUIPMENT
& SUPPLIES



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featuring

SELENIUM RECTIFIERS



CAPACITIES FROM 25 TO 10,000 AMPS., MAXIMUM VOLTAGE FROM 6 TO 60 VOLTS

MUNNING

MUNNING & MUNNING, INC.
202-208 EMMETT ST.,
NEWARK 5, N. J.

is both a safety fuse and an indicating light to isolate areas of trouble.

Vibratory Finisher

Universal Vibrating Screen Co., Dept. MF, 1745 Deane Blvd., Racine, Wis.



The Vibrol Metal Finisher is a high-speed vibratory tumbler developed for deburring, radii forming, coloring, grinding, and many associated operations employing standard tumbling media. Among the claims made for this new machine is its fast elliptical action and ease of operation that produces the desired results ten to twenty times faster than conventional methods.

The machine is presently available in two models. The V-20-1½ cu. ft. capacity model features its own wheel-mounted portable stand and a clamp-on wash-out cover. It is powered by a ½ hp., 1725 rpm, 110 v. splash-proof motor. The V-30-8 cu. ft. capacity model is a larger production-size version whose standard equipment includes a clamp-on wash-out cover and is powered by a 2 hp., 1725 rpm, 220/440-3 phase splash-proof motor.

Both models are designed to permit use of a variety of timer and reversing controls at slight extra cost.

Rust Preventive

Magnus Chemical Co., Inc., Dept. MF, Garwood, N. J.

Magnafilm 120, a new rust preventive that covers two to four times the area of most competitive products, yet provides years of indoor shelf-storage protection of metal stock, machine parts and assemblies, is composed of film-forming materials and rust inhibitors dissolved in safety solvent with water-displacing and fingerprint neutralizing compounds.

After application by brushing, spraying or dipping, the solvent evaporates, leaving a thin, semi-solid, transparent, polar film. It displaces all surface moisture and removes fingerprints. In addition, the product immediately and completely removes soluble oil emulsion that remains after a grinding operation. It protects parts and assemblies in process, in shelf-storage and when wrapped for shipment.

The semi-solid film does not crack with expansion and contraction of the protected metal, according to the manufacturer.

Extrusion Polisher

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

A new straight line automatic for finishing aluminum extrusions is equipped with platens which will accommodate 22 ft. long work pieces. The number of finishing heads used is determined by the condition of the rough extrusion and the final finish desired. The unit shown was equipped with seven 20 hp heads to remove die lines and bring up the luster.



The conveyor moves continuously and is loaded and unloaded at production speeds of up to 27 ft. per minute.

Automatic Ultrasonic Cleaning Unit

National Ultrasonic Corp., Dept. MF, 95 Park Ave., Nutley, N. J.

A system to clean printed circuit boards with mounted components was designed for production cleaning either as an automatic or manual



Dan Cavicchio, accordionist • Sally Ann Freeman, vocalist

You are Cordially invited

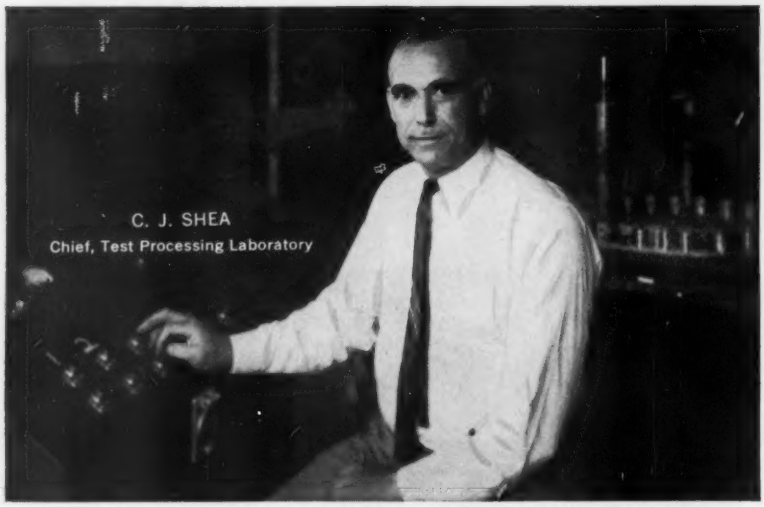
TO BE OUR GUEST DURING THE 1961 A.E.S. CONVENTION IN BOSTON

Cocktails, music and entertainment. Parlors B and C, Statler-Hilton Hotel, 5 to 7 p.m.

The Annual Udylite A.E.S. Ball in the Georgian Room of the Statler-Hilton Hotel on Thursday, June 22nd, 10 p.m. to 2 a.m. Jewel Tones by Guy Ormandy and his orchestra.

Udylite

THE UDYLITE CORPORATION
DETROIT 11, MICHIGAN



MEET THE PEOPLE BEHIND THE PACKER-MATICS

Some of our salesmen have labeled our Test Processing Laboratory, the "bad news department." Justifiably interested in making a sale, they can be awfully disappointed if the sample parts they send in from prospective customers for experimental buffing or polishing either don't represent the right kind of application for our automatics . . . production requirements turn out to be unrealistic . . . or, tooling gets fancier than originally expected.

But meeting the customers needs . . . both insofar as finish and quantity output are concerned . . . represent the only guides we follow. We must absolutely convince ourselves that the job is right . . . then we are in a position to issue the kind of reassuring guarantees people have come to expect with their Packer-Matics. There has never been any deviation from this established approach and the record our machines have made in operation over a 27 year period is the best evidence we can offer to prove our point. We know . . . our salesmen have learned . . . our customers have been convinced . . . Packer-Matics produce as specified . . . perform as promised . . . always.

C. J. Shea

Faced with a polishing, deburring, buffing or mechanical cleaning problem? Send sample parts, specifications and prints for free test evaluation . . . or write for free descriptive literature.


Model No. 1 Straight Line Conveyer

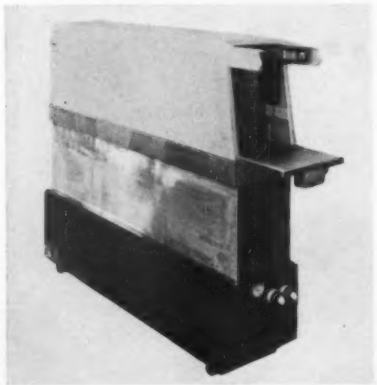

Model No. 14-45 Continuous Rotary


Model No. 13-10 Rotary Indexing


Model No. 4-5 Rotary Indexing

THE PACKER MACHINE COMPANY • 456 CENTER STREET • MERIDEN, CONN.
PIONEER MANUFACTURERS OF AUTOMATIC POLISHING AND BUFFING MACHINES

process. By combining the unique properties of DuPont fluorinated solvent, "Freon" and ultrasonic energy, the system removes both activated and non-activated fluxes and other contamination from assembled printed circuits, it is claimed.

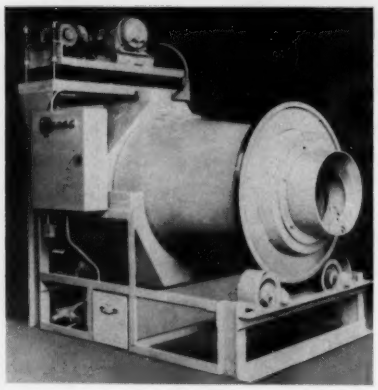


The new equipment can be used for either manual batch cleaning or as a fully automatic system. Pumps, filters and stills for both soak chambers are provided on either manual or automatic units.

Automatic Sawdust Barrel

Minnesota Mining and Mfg. Co., Dept. MF, 900 Bush Ave., St. Paul 6, Minn.

Automatic control of tumbling cycles, automatic separation and media retention and automatic discharge of finished parts are features of a new 36-inch sawdust barrel. Additional automation is afforded with a storage hopper and power loading equipment. Both are optional.



The "Honite" automated barrel is designed to minimize hand labor in batch drying and polishing metal parts. Gas heats the drum. A metal hood retains the heat in the tumbling compartment. Parts are fed in one end and discharged at the other. The media remains in the barrel ready for reuse, or can be discharged automatically.

A magnetic separator is standard equipment. It can be replaced by a vibratory separator, employing interchangeable screens, for drying and polishing non-ferrous parts. The barrel is modified for normal tumbling operations. That model includes automatic rinsing and magnetic separation, if required. A magnetic turnover device is available on both models to dump entrapped media from cup shaped parts for thorough rinsing.

Gold Electroplate

Sel-Rex Corp., Dept. MF, Nutley, N. J.

An extra high purity gold electroplating process, Temperex HD is said to meet or surpass the most exacting finishing specifications required by manufacturers of transistors and other electronic components. The new process reportedly produces deposits of 99.99+% purity, affording a uniformity of metallurgical characteristics never before attainable in gold electroplate.

Other advantages said to be offered include: hardness 75 Knoop, substantially greater than coatings produced from conventional or so-called "24 Karat" cyanide formulations; remarkable ductility — electroforms can be cork-screw twisted without fracturing, important to the function and relia-

bility of crimp-type connectors; exceptional machineability — no foreign codeposits to pit out during machining, important in slip rings and other applications where machining is performed subsequent to plating; easy soldering or welding — as necessary in the bonding of silicon directly to gold plate.

There appears to be no practical limitation of thickness — *electroforms* to 30-thousandths of an inch are easily produced under commercial operating conditions. This electroplate is also reported to exceed the requirements of such standard electronic product- acceptance tests as exposure to 550°C. /10 minutes; 300°C./96 hours in air.

Hot Paint Spray Unit

Spee-Flo Co., Dept. MF, 6614 Harrisburg Blvd., Houston 11, Tex.

A new, completely self-contained hot spray unit, the Chieftain Series II provides a full-range of temperature control for one or two guns and for hose line lengths from 10 to 60 feet, and maintains a uniform selected temperature control at the gun, producing a two coat requirement with a single spraying pass.



The system features a double action, divorced design pump which is suited for all types of materials from clear to highly abrasive. It is equipped with a newly patented recirculating assembly which allows constant recirculation of the heated material without return to the main supply. Temperature control is accomplished with the Pressurematic heater. It may be optionally equipped with an external temperature control.

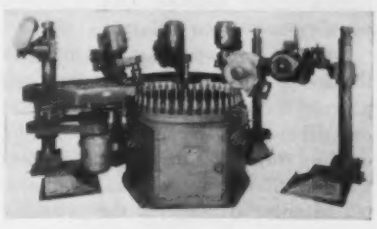
The unit is available in fixed or mobile models and is designed for use in industrial spray booths, large spray areas, or for field maintenance work.

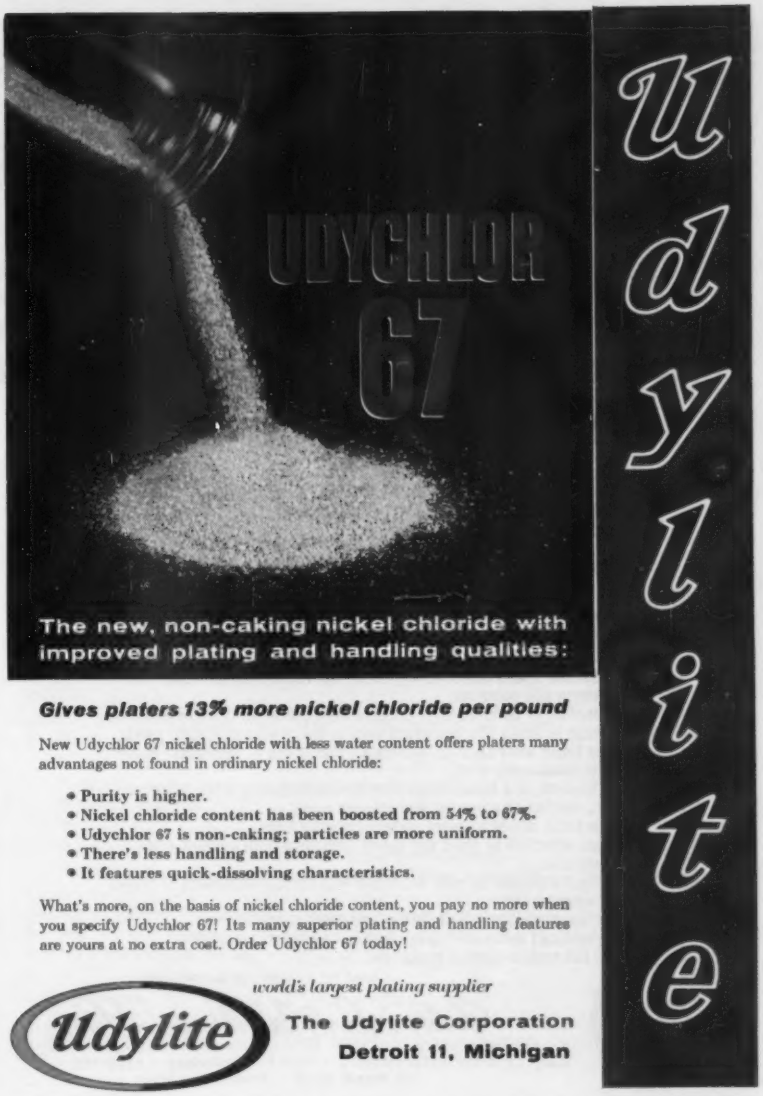
Automatic Polishing Machine

Acme Mfg. Co., Dept. MF, 1400 East Nine Mile Road, Detroit 20, Mich.

A new versatile automatic rotary polishing and buffing machine combines both indexing and continuous operation in one machine for production flexibility. The machine can be easily converted, in less than one minute, from rotary indexing to continuous rotary motion or vice versa to permit finishing operations on a variety of parts.

The machine consists of a series of easy replaceable cartridge type spindles mounted on a rotary table. The individual drive motors for the index drive, the continuous drive and the spindle drive can each be varied to meet specific job finishing requirements. The index drive consists of a Geneva index mechanism. A timer control permits variable index speeds when required. Index dwell time de-





ARMORETTE . . . NOW A MODERATE-COST TEXTURED VINYL FINISH CAN BE APPLIED AT LOW BAKING TEMPERATURE



Beckman Electronic Counter, with an ARMORETTE textured vinyl finish applied at low baking temperatures.

Used successfully on electronic equipment, furniture, vending machines, interior and exterior automotive applications, ARMORETTE has a number of outstanding features. Among them:

- Low baking temperature. ARMORETTE can be baked at temperatures as low as 160°F and has been applied to such materials as wood, chipboard and polyester.
- A selection of textured vinyl finishes from coarse finishes resembling alligator to those like laminated vinyl or the more costly vinyl paints.
- Three times more abrasion resistance than gloss or semi-gloss enamel and of comparable cost.
- Can be used on a broad range of materials including steel, aluminum, wood, reinforced polyester and pressed wood.
- Remarkable ability to cover surface imperfections.
- A wide selection of gloss and colors, including both metallic and non-metallic.
- Excellent adhesion to most materials with surface treatment or primer not required.
- Superior durability in both indoor and outdoor applications.
- Excellent salt spray, humidity, chemical and scuff resistance.
- Does not require special equipment.

Send for Bulletin and Sample Panel

ARMORETTE

John L. Armitage + Co.

SYNTHETIC ENAMELS • VINYLS • VARNISHES • LACQUERS
245 Thomas Street • Newark, New Jersey

pends on finishing requirements.

The continuous table drive and spindle drive are both equipped with a 3 to 1 ratio variable speed unit which provides the desired table and spindle speed. The spindles are chain driven and automatically disengage from the chain and stop rotating in the load and unload stations. A spring loaded chain take-up and tightener provide easy chain adjustment.

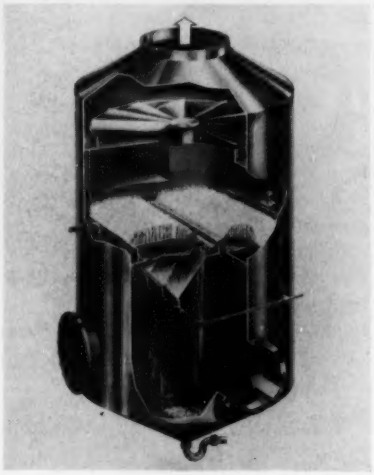
Safety limit switches control both the index and continuous drives and prevent the accidental engagement of one drive while the other drive is operating. An air lift that is synchronized with the table index can be incorporated to automatically lift the polishing and buffing heads from the work during the index cycle.

The machine is available in a 5½ ft. diameter size with a 7 station index, in an 8 ft. diameter size with 8 station index and in 10 ft. diameter size with 12 station index. The number of spindles used under continuous operation can be varied to suit the individual job requirements.

The adjustable lathes can be equipped with manual controls or automatic interchangeable power drive units for "raising" and "lowering" and providing "in" and "out" positioning of the wheel heads and to provide automatic wheel wear compensation in preset cycles and feed amounts.

Fume Scrubber

W. W. Sly Mfg. Co., Dept. MF, 4700 Train Ave., Cleveland 1, Ohio.



The "Impinjet" gas scrubber is said to provide a high efficiency scrubbing action with low operating and maintenance costs. Both single and multiple impingement plate units are available. Scrubbing is accomplished by the turbulent interaction of gas and liquid, as effected by the stainless steel impingement baffle plate.

The single-stage scrubber handles dust loadings at inlet of up to 100 grains per cubic foot. It can remove suspended materials in a gas stream that range from sub-micron fumes to dust particles in the larger micron sizes, with efficiency in excess of 99% on many types of dust.

Because of the simple design, pressure drop and resulting power requirements are low. Liquid consumption is only 1 to 3 gallons per 1,000 cfm at 20-40 psig. A single-stage unit can have a pressure drop as low as 2½" while maintaining high efficiency. Where extra-high efficiency is desirable, additional plates can be added without increasing liquid consumption.

Because there are no moving parts in the scrubber, maintenance costs are low. Less space is required for installation than other types, and the units can be furnished with round shells or rectangular casings to fit the particular installation space.

Rhenium Plating Salts

Technic, Inc., Dept. MF, P.O. Box 965, Providence, R. I.

Rhenium A Plating Salts, recently introduced, are expected to have a

broad range of high temperature and experimental plating applications. Rhenium, a metallic element with unique and valuable properties, has the highest melting point of any platable metal (5,732 degrees F.). It is expected to be of great use in such high temperature applications as contacts and sealed relays.

Rhenium has extremely low arc erosion, fair electrical conductivity, and stable contact resistance. It is the second densest (20.53) of the platable metals and has excellent resistance to the water cycle. Rhenium A solutions are said to be stable, have good throwing power, and offer constant current efficiency over a wide range of current densities.

Safety Tape

General Bandages, Inc., Dept. MF, 8300 Lehigh Ave., Morton Grove, Ill.

Guard-Tex self-sticking tape guards fingers, wrists, lower forearms from sparks, cuts and puncture wounds during grinding operations. Burrs on rough metal stock often are to blame for injuries to unprotected hands and fingers.

Pedestal Belt Grinder

Bush Mfg. Co., Dept. MF, 900 Rochester Road, Clawson, Mich.

A new heavy duty abrasive belt grinder, featuring an 8 way adjustable work table, adjusts for angular or compound angular application. The table raises, lowers, and tilts to the right, left, up or down, and also can be brought close to belt and platen or can be retracted.

The machine is equipped with 3 h.p. motor, automatic constant belt tension head and quick release for easy belt change. Roller, flat or contoured platens are available.



Ultrasonic Cleaning Solutions

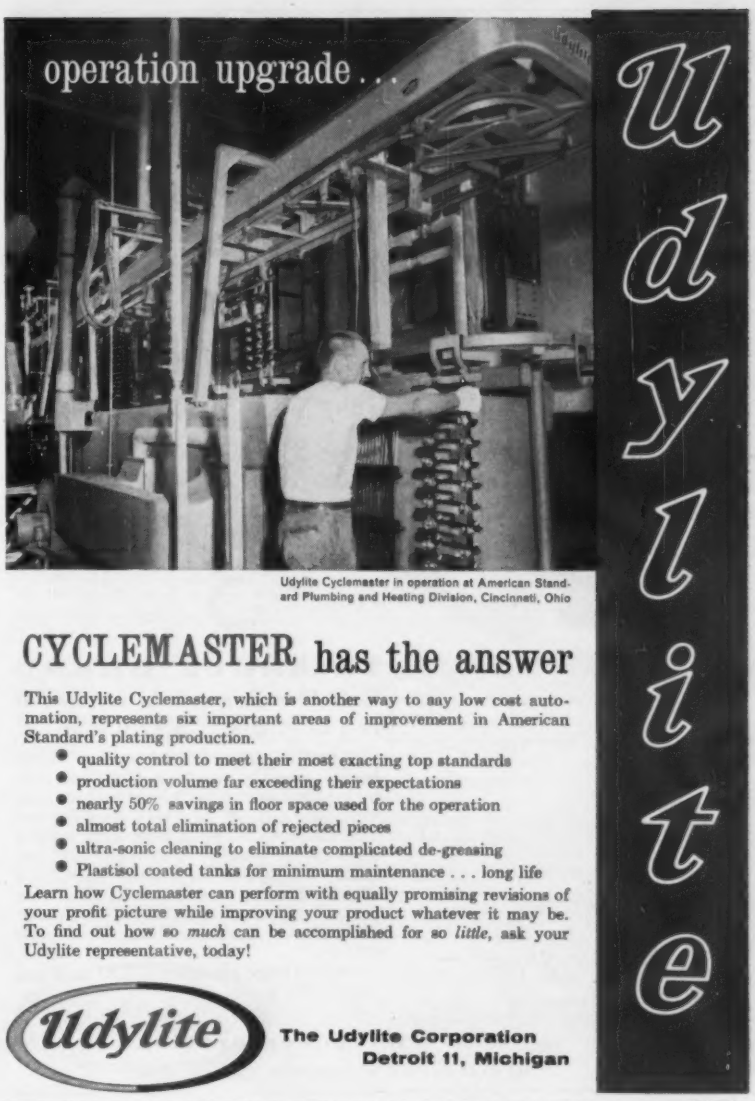
L & R Mfg. Co., Dept. MF, 577 Elm St., Kearny, N. J.

Three specialized cleaning solutions are now available for a wide range of ultrasonic applications.

#222 is a waterless, ammonia-free solution, especially formulated for use in cleaning operations where the use of ammonia would not be chemically desirable. It is able to impart, to copper, brass and steel parts, a brilliance and luster that was previously possible only with the use of ammoniated cleaners. And, since it contains no volatile ammonia, the solution does not lose its exceptional cleaning properties by dissipation in the atmosphere.

#112, (ammoniated), is ideal for the removal of gummed oil and grease, oil-soluble cutting oils, asphalt and tar, carbonized residues, sulphides, waxes, fluxes, ordinary oil and fingerprints and other foreign particles.

Hydro-Sonic cleaning solution concentrate, when diluted with seven pints of water, will produce a gallon of solution capable of instantly removing all water-soluble soils, fingerprints, lapping compounds and cutting oils, waxes, rouges and tripoli from metal, glass and plastic. It is completely rinsable in water.



Udylite Cyclemaster in operation at American Standard Plumbing and Heating Division, Cincinnati, Ohio

CYCLEMASTER has the answer

This Udylite Cyclemaster, which is another way to say low cost automation, represents six important areas of improvement in American Standard's plating production.

- quality control to meet their most exacting top standards
- production volume far exceeding their expectations
- nearly 50% savings in floor space used for the operation
- almost total elimination of rejected pieces
- ultra-sonic cleaning to eliminate complicated de-greasing
- Plastisol coated tanks for minimum maintenance . . . long life

Learn how Cyclemaster can perform with equally promising revisions of your profit picture while improving your product whatever it may be. To find out how so *much* can be accomplished for so *little*, ask your Udylite representative, today!

Udylite

The Udylite Corporation
Detroit 11, Michigan



for long-lasting plating **TRIANGLE BRAND**
COPPER SULFATE
NICKEL SULFATE

TRIANGLE BRAND Copper and Nickel Sulfates help give you the hardness you need for long lasting plating. They have purity, uniformity, solubility and high conductivity. This all around dependability *does* make a difference. Therefore we suggest that you specify Triangle Brand Copper Sulfate and Triangle Brand Nickel Sulfate for all of your plating work. Send today for the free booklet "The Use of Copper Sulfate for Copper Plating."

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BUSINESS ITEMS

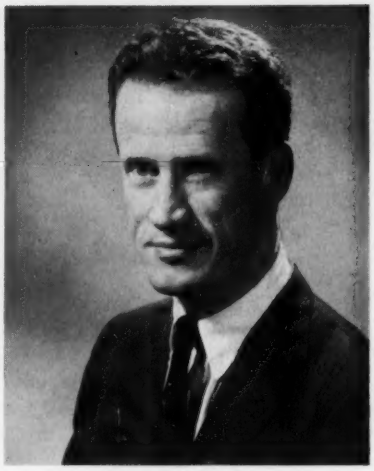
H-VW-M Elects Board Chairman and President

Louis M. Hague was elected chairman of the board and chief executive officer of *Hanson-Van Winkle-Munning Co.*, at a directors meeting following the annual stockholders' meeting recently. At the same time *Warren S. Wilkinson* was elected president. Mr. Wilkinson had been executive vice-president of the company since 1958.

Mr. Hague joined the firm in 1928,



Louis M. Hague



Warren S. Wilkinson

and was elected to the presidency in 1948. He had formerly been a vice-president of the company. He is a member of the board of directors of Alert Supply Co., Los Angeles, the New Jersey Manufacturers Casualty Insurance Co., and the New Jersey Manufacturers Indemnity Insurance Co., both of Trenton, N. J. From 1943 to 1947 he was Mayor of Rumson, N. J.

Mr. Hague, a 1923 graduate of Lafayette College, is a former alumni councilman, and a past president of the Pittsburgh Alumni Association and the North Jersey Shore Alumni Association.

Mr. Wilkinson joined the company in 1946 as plant engineer. In 1949, he became assistant purchasing agent and, in 1956, he was appointed assistant to the president.

Mr. Wilkinson was graduated from Harvard University in 1941 and, in the following year, attended California Institute of Technology, working toward an advanced degree in mechanical engineering. Following this, he was associated with a tire manufacturer in Detroit.

Mr. Wilkinson is a member of the board of directors of the Evening News Association, publishers of the Detroit News.

Miller Named Technical Field Rep. for Deering Milliken, Inc.

Deering Milliken, Inc., New York City, announces the appointment of *David J. Miller* as technical field representative for the company's buff cloth sales program.

Mr. Miller's duties are to acquaint metal finishers nation-wide with fea-



David J. Miller

tures of the various buff cloths, and to offer technical assistance in their buffing operations. He is a member-at-large of the A.E.S. and its Project 18 Research Committee.

New Corporation Formed

Kaykor Industries Div. of Kaye-Tex Mfg. Corp. has been purchased by *J. L. Huscher*, and is now being operated as *Kaykor Products Corp.*, an independent company.

The firm produces a variety of vinyl, styrene, and other thermoplastic sheet laminates, for use in corrosion resistant applications as well as other industrial and commercial fields.

New Plant for Du Pont in Texas

The Du Pont Company has announced it will construct a new plant at Orange, Texas, to produce high-pressure polyethylene and a new product, "Elvax" vinyl resin, a copolymer of ethylene and vinyl acetate. The new polyethylene unit will bring the firm's over-all polyethylene capacity to nearly 400,000,000 pounds.

The plant, to be built at the company's Sabine River Works, is scheduled for completion in the third quarter of 1962.

Conway Named to Coatings Sales Post by M&T

Earl J. Conway has been appointed a coatings specialist for *Metal & Thermit Corp.*, and has been assigned special responsibilities for the marketing of the company's organic coatings line in the Detroit area.

Mr. Conway, who received a B.S. degree in chemistry and geology at the University of Chicago in 1932, has spent his entire business career in sales and technical positions in the organic coatings and metal finishing industry.

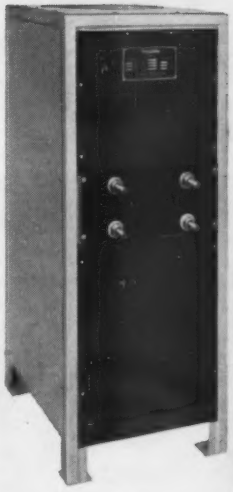


Earl J. Conway

Recently the head of his own coatings operation, E.J.C. Associates, he has also served as Detroit sales manager for the Electro-Chemical Engraving Co. Prior to that he held various sales and technical posts with the Rinshed-Mason Co., Jones-Dabney Co., Sherwin-Williams Co., and E. I. du Pont de Nemours & Co., Inc.

Sel-Rex Appoints Stocker District Manager for New England

The appointment of *Oscar A. Stocker* as district manager for the New England states has been announced by *S. S. Wilson*, vice-president and general sales manager, *Sel-Rex Corp.*, Nutley,



take advantage of the

NEW PROJECT ALERT RECTIFIER PROGRAM



Rebuild your old equipment now!

Now's the right time to let Udylite electrical equipment specialists rebuild your old, inefficient, 6-, 9- and 12-volt UM and UV rectifiers. You can obtain all of the advantages of a completely new silicon unit at a cost just slightly more than a silicon diode replacement kit. With the exception of the transformer, you'll have *a brand new rectifier from top to bottom.*

NEW, MODERN CABINET features slotted side panels for easy removal and replacement.

UNIFRAME CONSTRUCTION gives increased ruggedness, reduces overall weight.

NEW DIODE ASSEMBLY has newly-designed, one-piece, solid copper, finned heat sink and improved, non-aging silicon diodes with ceramic insulation and individual fuse protection.

NEW VENTILATION SYSTEM with new fan-housing assembly and permanent, built-in baffling assures highest ventilation efficiency.

NEW, LOW HEIGHT saves space. D.C. terminals are located in same relative position, thus new bussing is not required for re-installation.

All transformers are full-load tested before and after re-manufacturing. It will pay you to investigate the many benefits of the Udylite Project Alert factory conversion program today. For conversion of other old-style Udylite Rectifiers to economical silicon units, contact your local Udylite Representative.

SILICON CONVERSION KITS—Udylite Silicon Diode Kits are also available for UV and UM rectifier conversion right in your plant. A specially fabricated heat sink assembly, complete with diodes and fuses, permits fast, easy installation.

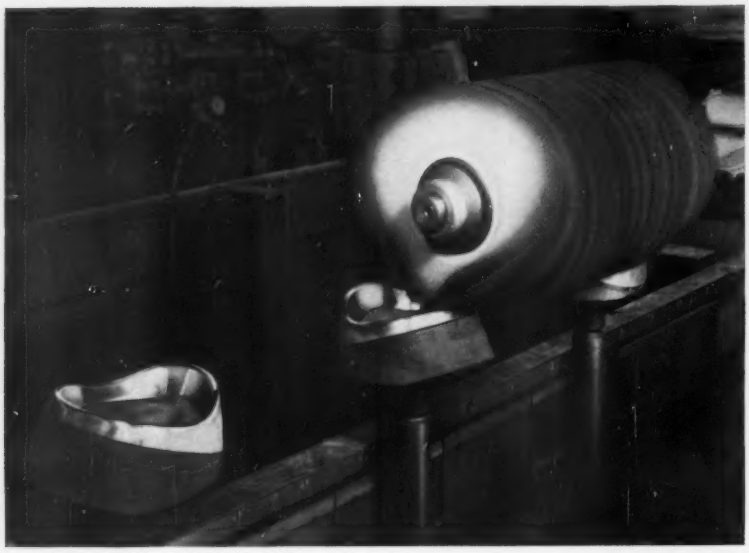
Udylite

The Udylite Corporation
Detroit 11, Michigan

udylite

ACME IN ACTION





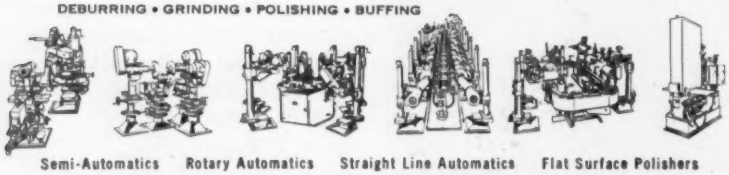
Doing more work with *Movement and Motion*

Good example of versatility in quality finishing equipment is the Acme Automatic Straight-Line Machine shown in action above. It's the "universal" type—one of many basic modular unit designs pioneered by Acme during the past 50 years to do more work better with movement and motion.

Made of standard sections assembled to any length desired, it can incorporate any number and combination of standard adjustable Acme heads designed to perform a variety of operations on a wide range of parts. Deburr, grind, polish and buff. Work-holding fixtures can be arranged for automatic lock and unlock. And the parts themselves can be run in a fixed position, rotated in one or both directions, or cammed as may be required to finish specific areas, assure ultimate uniformity of product quality.

Other types of Acme automatic straight-line polishing and buffing machines include Reciprocating, Fixture-Return, Horizontal-Return, Over-and-Under, Rotary and Rectangular. Send for complete information today!

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Leading Producers of Automatic Polishing, Buffing and Deburring Machines Since 1910



Oscar A. Stocker

N. J. Mr. Stocker, in addition to promoting the firm's precious metal plating processes, will represent the complete electroplating and metal finishing equipment, chemicals, and services offered by its subsidiary, *The Meaker Co.*

A graduate Chemical Engineer of the University of Michigan, Mr. Stocker has held technical and executive positions in the electroplating industry for over 35 years.

Carborundum Promotes Walker and Gillmore

Bruce Walker has succeeded *Joseph S. Imirie* as general manager of the Electro Minerals Div. of *The Carborundum Co.*, and *Dr. Donald W. Gillmore* succeeds Mr. Walker as manager of the division's technical branch. This double promotion followed President Kennedy's appointment of Mr. Imirie, formerly vice-president of the company and general manager of the division, as assistant secretary of the U. S. Air Force for materiel.

Mr. Walker, a native of Canada, after graduating in 1942 from the University of Toronto with a Bachelor of Science degree in chemical engineering, joined Canadian Carborundum as technical control laboratory assistant. He was successively product engineer for diamond and resinoid wheels, and then manager of product and process engineering. In 1959 Walker was appointed manager of the technical branch of the Electro Minerals Div. of the parent firm in Niagara Falls, N. Y., the position he held at the time of his promotion to general manager of the division.

Dr. Gillmore, who holds a Bachelor

of Science degree in chemistry from Williams College and a Ph.D. degree in chemistry from Penn State University, joined the Division in 1960 as manager of the development department of the technical branch of which he is now manager. Previously, Dr. Gillmore was head of carbon research at Pittsburgh Coke & Chem. Co., Pittsburgh, Pa.

Baird Appoints Four New Distributors

The appointment of four new selected distributors has been announced by the Barrel Finishing Equip. Div., *Baird Machine Co.*, Stratford, Conn.

Aldachris Ultrasonic Distributing Co., Cleveland, Ohio, will cover the area of Northern Ohio and Western Pennsylvania.

Davies Supply & Mfg. Co., with sales offices and warehouses in St. Louis, Mo., Kansas City, Mo. and Dallas, Tex., will handle the southwestern territory.

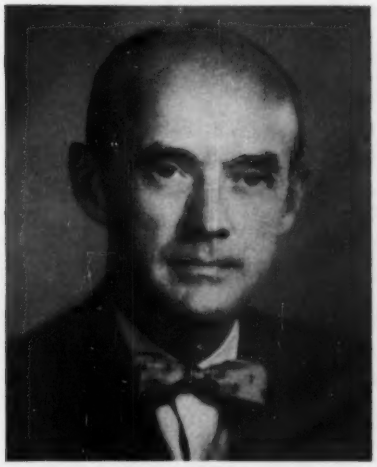
The Southern Ohio, Southern Indiana, West Virginia, Virginia, Eastern Tennessee and Kentucky area will be handled by *Bill Young Co.* of Cincinnati.

Donald Sales and Mfg. Co., Milwaukee, Wisc., will cover the state of Wisconsin.

Udylite Board Names New Vice-President

Robert C. Trees has been named vice-president, Marketing by the board of directors of *The Udylite Corp.*, world's largest supplier of metal finishing equipment and materials, it was announced by *L. K. Lindahl*, board chairman.

Mr. Trees joined the organization in



Robert C. Trees

ATLANTIC
GREASELESS COMPOUNDS
with Exclusive K-134 additive give
Highest Quality Finish!

Atlantic greaseless buffing compounds with K-134 work faster, more economically, and most important, produce a *higher quality finish* on metal, plastics, and wood. Atlantic compounds are uniform . . . you'll get the same good results tube after tube. Atlantic manufactures *only* greaseless compounds. Rigid quality controls and constant research enable Atlantic to offer the finest finish compounds for all applications. Technical data, assistance and samples furnished on request. Call your Atlantic distributor today.



K-134, Atlantic's exclusive miracle additive, enables these compounds to:

- Reduce Application Time
- Adhere better to buffing wheels
- Cut down costly waste
- Assure uniform satin finish



ATLANTIC COMPOUND CO.

6 Charles St., Chelsea 50, Mass.

MANUFACTURERS OF GREASELESS COMPOUNDS ONLY

1943 and was formerly director of advertising. His responsibilities include corporate advertising, public relations, sales promotion, and market research.

After graduating from DePauw University, Trees attended Columbia University where in 1923 he received his B.S. degree in Business Administration. He is presently a member of several professional organizations including: Engineering Society of Detroit; American Electroplaters' Society; Detroit Press Club; a past president of the Industrial Marketers of Detroit, and a Trustee of the Metal Finishing Suppliers' Association.

Brucar Equipment and Supply at New Location



Brucar Equipment and Supply Co., Inc. announces the acquisition of new and larger quarters at 45 E. Merrick Rd., Freeport, L. I., N. Y. *Jerry Alter*, president, states that the move was necessitated by the increased demand for the firm's corrosion and acid resistant fiberglass tanks, crocks, and exhaust systems. The firm will continue to manufacture and distribute a complete line of plating equipment and associated supplies.

New Model D
WINSCOTT
(The Original In-Tank)
FILTER
for $195.00 and no extras

Superior Characteristics and Operating Dependability at Lowest Cost

NEW Temperature Tolerances . . . well above operating limits of all plating baths (160° +)

NEW Corrosion Resistance . . . withstands all acid and alkaline type baths including high chloride nickel baths

NEW Higher Flow Rates . . . up to 360 gal./hr. with clean baths

NEW Cartridge Filtration . . . for easier, faster economical changes where extremely minute particle size is not critical. (Other Winscott models employ filter bags with or without filtering media.)

NEW Shallow Solution Levels . . . for precious metals. As low as 3 inches now possible with bottom intake design. Keeps sludge out of tanks.

Compare Features and You'll Choose WINSCOTT — First and Still Best In-Tank Filter Available



Fully Enclosed, Continuous Duty, Induction Type Motor is *STANDARD* on the *WINSCOTT*. No brushes to wear out and drop contaminating particles into the tank. No need to shut down the filter as with intermittent types. Efficient 3450 r.p.m. speed operates quietly without irritating whine of higher speed motors. Powerful ⅓ h.p. capacity of the Winscott guarantees against overloading at maximum flow rates.

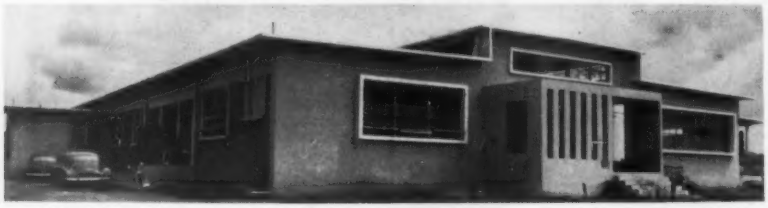
Write for details and name of your nearest distributor.

The Chemical Corporation
58 Waltham Avenue, Springfield 9, Mass.

Baker Bros. to Hold Open House

On Tuesday, June 20th, *Baker Bros., Inc.* of Canton, Mass., will hold an open house at their plant located on Route 138. Chartered buses will leave from the Statler Hilton Hotel at 1:30 P.M. Finishing equipment of various kinds will be in operation under load conditions, and one piece of equipment will be auctioned off, with the proceeds to go for cancer research. *Robert Baker* is in charge of arrangements.

Rapid Electric to Open Plant in Puerto Rico



Rapid Electric Co. is completing a new plant, its fifth one, in Arecibo, P. R. The 12,500 sq. ft. building, to open in July, will house complete facilities for the fabrication of metal cabinets for standard line or custom rectifiers. It will also be used for subassembly work of standard rectifiers.

Enthone Man Receives Distinguished Salesman's Award

Albert J. Kolb, sales engineer for *Enthone, Inc.*, New Haven, Conn., was presented a Distinguished Salesman's Award by the Sales Executives Club of New Haven at their 4th Annual Distinguished Sales Award Dinner. The affair was held recently at Waverly Inn in Cheshire and was attended by more than 500 sales executives, including a large group from Enthone and its parent company, American Smelting and Refining Co.

Save 25% or more* with Luster-on® complete package treatment for aluminum products

If you manufacture or finish aluminum parts for aircraft, air conditioning, automotive, marine, household, building, hardware, window and allied uses, YOU CAN SAVE 25% OR MORE and still MEET GOVERNMENT SPECIFICATIONS! Simply GO LUSTER-ON ALL THE WAY. Here's the cycle:

1. **LUSTER-ON CLEANERS**
   No. 400—Non-etch type, free-flowing, granular, 100% active with good hard water tolerance; or
   No. 416—Etch type, non-sludging, non-scaling. Acts uniformly and easier to desmut after etching.
2. **LUSTER-ON DE-OXIDIZER No. 480**—Room temperature operation with no noxious fumes. Safer than nitric acid. Dry, granular, free-flowing.
3. **LUSTER-ON SEALER No. 222-M**—A chromate type conversion coating, meeting government specification MIL-C-5541, gives corrosion protection and acts as a paint base. Maximum corrosion protection with brush, dip or spray applications in 10 seconds to 3 minutes. Clear or yellow films. Extremely economical.

*Compared against other popular materials.

For the complete aluminum treatment specify Luster-on

The Chemical Corporation
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Springfield 9, Massachusetts



Albert J. Kolb (center) receiving trophy from W. John Blaiklock, president of the New Haven Sales Executives Club, as Mrs. Kolb looks on admiringly. On left is guest speaker, Dean W. Jeffers.

The award is presented annually to outstanding salesmen whose achievements have fostered the ideals of free competition in America. Mr. Kolb was selected because of his fine record during his 3½ years of selling for his firm during which time he substantially increased sales in his territory.

Handy & Harman Moves Executive Headquarters

Handy & Harman, the nation's largest fabricator and refiner of gold, silver and other precious metals, has moved its executive offices after 94 years of transacting business in New York's traditional financial district in lower Manhattan. The company is now located at 850 Third Avenue, New York, in new executive offices.



Formed in 1867 as a banking firm dealing in silver and gold bullion, specie and bonds, the company was one of many precious metal firms once located in New York's jewelry and financial district.

Chemclean Establishes Canadian Company

Chemclean Products Corp., announces the formation of its affiliated company, *Chemclean Products of Canada, Ltd.*, 72 Crockford Blvd., Scarborough, Toronto. Its Canadian affiliate will produce a complete line of industrial cleaners, strippers and proprietary chemicals for the metal finishing, plastics and welding industries.

Industrial Filter Appoints Export Manager

Ignacio Velazquez has been appointed export manager of *Industrial Filter & Pump Mfg. Co.*, Cicero, Ill. The announcement was made by *James F. Zievers*, president of the firm's subsidiary, the Foreign Sales Div., Inc.

Prior to his association with the





Ray E. Habermann, Jr.

assist in the expansion of industrial sales and in the market development of new products.

Mr. Habermann was previously president of Viking Safety Products, Inc., Minneapolis, Minn. and, from 1950 to 1959, he was associated with the F. H. Bathke Co., St. Paul, an industrial supply company. He is a graduate of Princeton University and also attended Stanford University Graduate Business School.

Two Elected to Chemetron Board

Two new members of the *Chemetron Corp.* board of directors, *William W. Whitnell*, corporate vice-president, secretary and controller, and *Roy T. Omundson*, corporate vice-president and president of the Cardox Division, were elected by stockholders at the annual meeting.

Whitnell joined the company in 1943 as controller, became secretary in 1946 and vice president in 1957. Omundson, vice-president since 1959, has been president of the Cardox Division since 1958 and was previously president of Cardox Corp.

Platronics Names Kankowski Sales Manager

Platronics Division, *Palumbo Bros., Inc.*, industrial electroplaters since 1915, has named *Gene Kankowski* sales manager, according to an announcement. Formerly a production executive in the electronics industry for several years he originally joined the division as a sales engineer in April of 1960.

Prior to joining the firm, Mr. Kankowski was associated in manufactur-



Ignacio Velazquez

firm, Velazquez was connected with Goss Printing Press International, Chicago, and Ceballos & Kayser Co., New York.

Born in Medellin, Colombia, Velazquez has an engineering degree (BSEE) from the Milwaukee School of Engineering and also studied at the University of Bolivariana. He served two years in Europe with the U. S. Army Engineering Corps.

Habermann Joins Economics Laboratory, Inc.

Ray E. Habermann, Jr., has been named assistant to the director, Industrial Products Division of *Economics Laboratory, Inc.*, Guardian Building, St. Paul, Minn. Mr. Habermann will



Gene Kankowski

ing or production executive capacities with L. L. Constantine, U. S. branch of McCulloch Co. of Canada, Ltd., and with C-O-Two Fire Equip. Co. Mr. Kankowski, who attended Newark College of Engineering, also holds a B.S. Degree in Accounting from Seton Hall University.

Dr. Sheldon Joins Carborundum

Dr. Zachary D. Sheldon, formerly manager, Advanced Materials Development, General Engineering Laboratory, General Electric Co., Schenectady, N. Y., has joined *The Carborundum Co.* as associate director of the Research and Development Division.

Dr. Sheldon is a graduate of the University of Connecticut and obtained his M.S. degree from Columbia University and his doctorate from the University of Rochester. He was a member of the Wartime Manhattan Project Research Department at Columbia University under Dr. Harold Urey and later, the Gaseous Fusion Project at Oak Ridge. He is the author of numerous classified and unclassified publications and patents, and a member of the American Chemical Society, American Rocket Society, International Combustion Institute, American Association for Advancement of Science, New York Academy of Sciences, and holds several Honorary memberships.

Dr. Sheldon will assist in supervising the firm's expanding research and development programs. He will reside in Buffalo, New York.

Graver Announces New Representative

Graver Water Conditioning Co., New York, has announced the appointment of the *Metrol Co.* as engineering representatives for the lower peninsula of Michigan. They will carry a complete line of industrial, utility and municipal water treatment, industrial waste treatment and chemical processing equipment.

The Metrol office, staffed by a group of power and process plant equipment specialists, is located at 7145 E. Davison, Detroit.

Leon J. Barrett Co. Elects New Officers

Robert B. Ayres was elected president and treasurer and *Dwight C. Page* re-elected executive vice-president at recent stockholders' and directors'



Robert B. Ayres





Dwight C. Page

meetings of the *Leon J. Barrett Co.*, Worcester, Mass., manufacturers of centrifugal machinery for numerous industrial applications.

Mr. Ayres has been with the company since 1950 and for the past nine years has been sales manager.

Narda Adds a Product Engineer

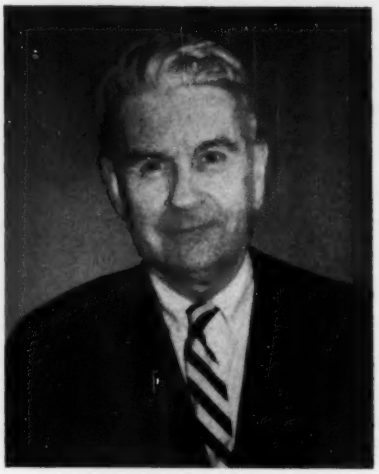
Frank M. Lefor, a mechanical engineer with a rich background of experience in designing electronic systems, instrumentation, and automatic machinery, has joined *Narda Microwave Corp.*, Mineola, N. Y., as product engineer. He will be responsible for the mechanical design of new products and for re-designing some of the company's existing products to achieve economies in manufacturing costs.

Most recently with PRD Electronics, Inc., where he served as mechanical project engineer on microwave and electronic test equipment, Mr. Lefor was previously with American Bosch Arma Corp., and with Republic Aviation Corp. Earlier, he had been a designer for Control Instrument Co., and for James W. Ormsby, Inc.

Mr. Lefor is a graduate of Brooklyn Polytechnic Institute (B.M.E., 1950).

Moore Joins Crystal Essence Corp.

George T. Moore, Jr., for many years associated in an executive capacity with the Chipman Chemical Co., Inc., has taken the position of general manager of the *Crystal Essence Corp.* in Bound Brook, N. J. *Dr. William E. Decker*, president, announced that it is expected that Mr. Moore will be elected executive vice-president at the Directors' Meeting in July.



George T. Moore, Jr.

Russell Elected V.P. and Director of Acoustica Associates, Inc.

Rollin M. Russell has been elected executive vice-president and a director of *Acoustica Associates, Inc.* Russell,

M. E. BAKER COMPANY

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THE AMERICAN ELECTROPLATERS SOCIETY
48TH ANNUAL CONVENTION

Boston, Mass. — June 18-23, 1961

We sincerely hope you will enjoy your visit to historic Boston and find time to visit our modern facilities in Cambridge to view the outstanding used equipment values we have to offer.

Co-Sponsors of Ladies Luncheon - Tuesday, June 20, 1961, 12 Noon
Castle Hill - Crane Estate - Ipswich, Mass.

M. E. BAKER COMPANY

25 WHEELER ST., CAMBRIDGE, MASS.

Serving the Electroplating Industry Since 1929



Rollin M. Russell

who also assumes the new position of chief operating officer, served previously as executive vice-president of Electronic Specialty Co., and as vice-president and group executive for Hughes Aircraft Co. Prior to this, he was manager of the Turbine Division of Continental Aviation and Engineering Corp. and manager of special products for Bendix-Pacific Division of the Bendix Corp.

Russell also was associated with the Johns Hopkins University's Applied Physics Laboratory and with the Columbia University Underwater Sound Laboratory. He received his B.S. degree from the University of Wisconsin and took graduate training at Wisconsin and Northwestern University. He will be based at company headquarters in Los Angeles.

Macco Appoints Reichel to Head Customer Service Department

The *Macco Products Co.*, 9210 S. Sangamon St., Chicago 20, Ill., manufacturers of cleaners, rust preventives and other chemical compounds for the metal working industries, has appointed *George P. Reichel* to the position of manager of customer service, succeeding *Arthur A. Warford*, who passed away in October of last year.

At the University of Wisconsin, Reichel concentrated his studies in the fields of biology and chemistry. He was a research assistant at Northwestern University Medical School, a high school teacher in general science, chemistry and biology with the Chicago Board of Education and, in the industrial field, he gained wide and



George P. Reichel

valuable experience in a compounding plant for Cities Service Oil Co.

Diversey Has New Chicago Headquarters

The *Diversey Corp.* has moved its general offices, research and development laboratories, and Central Division sales offices to a modern five-story air-conditioned building in downtown Chicago.

FIBRE GLASS TANKS, CROCKS & EXHAUST SYSTEMS

F abricated to any given dimensions. Our *No Mold* process enables us to produce a uniform thickness to meet your particular specifications, at *No* extra cost.

I deally suited to almost all plating baths, acids, alkalies, anodizing, brite-dips, rinses, etc.

B road selection of fittings such as drains, dams, outlets, couplings, etc. are available.

R einforced flanged tops and center supports are standard. Corners are triple reinforced with special material.

E xhaust casings, blowers, ducts, and complete systems for acid fume removal assure long trouble free life.

G lass reinforced fibres sealed in thermosetting resin provides long life, strength, rigidity, as well as corrosion, heat and chemical resistance. Electrically Non-conductive.

L ight weight, easily portable, and set into a new or existing cycle, without effort.

A cid resistant inside and out. *Never* requires painting or maintainence. Will not corrode or show wear.

S tructurally stronger than steel, although light in weight, the tensil strength is equivalent to or greater than steel.

S tandard sizes in stock. Others can be furnished on short notice. Let us quote on your requirements.



TANKS



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CROCKS

(Several Territories Still Available to Distributors)

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GOLD PLATING
SOLUTIONS

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Electrolytic
Precious
Metals!

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Antique Gold Solution

- GOLD LIQUID CONCENTRATE
- POTASSIUM GOLD CYANIDE SALTS
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- VARIABLE-TYPE TANK RHEOSTATS — SPECIALLY DESIGNED FOR PRECIOUS METAL PLATING.

ALL DAVIS-K GOLD PLATING SOLUTIONS ARE:

- Made in all colors
- Color constant
- Tarnish-resistant
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- Bottled by Troy Weight
- Made from U. S. Treasury Gold only
- Ready for immediate use

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SEL-REX PATENTED KARATCLAD
ACID BRIGHT GOLD PLATING PROCESS

We are fully equipped to reclaim old gold and rhodium solutions.
No charge for small sample plating.
Write Dept. MF for details.

FREE
Consultive Service
Call on Davis-K process engineers for help with your special plating problems and installations.

"Where Glittering Elegance Reflects Lasting Quality."

100% PURE GOLD SOLUTIONS DKP

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LOngacre 4-1978-9



Maurice Bick

facturer and national marketer for the metal, electronic, electrical and finishing industries.

Mr. Bick, who will direct the recently launched expansion and acquisition program, is a former general manager of the company, and started his career with the firm thirteen years ago as a chemical engineer.

He is a graduate of Lehigh University with a B.S. degree in chemical engineering, and is a member of the American Chemical Society, the Paint, Varnish and Production Club and Tau Beta Pi.

Imes Now President of Semet-Solvay Div. of Allied Chemical Corp.

The appointment of *Harold E. Imes* as president of its Semet-Solvay Division *Allied Chemical Corp.*, has been announced.

Starting as assistant chemist at its Ironton, Ohio plant laboratory in 1922, Mr. Imes has spent his whole business career with the division, rising through various operating assignments to superintendent of the Ashland, Ky. plant in 1933. In 1943 he became division superintendent for the Ashland and Ironton plants and river transportation. In 1951 he moved to the general offices in New York as assistant general superintendent, and was named director of operations in 1956.

Mr. Imes was appointed vice-president of the Division in 1958. He succeeds *Albert E. Scherm*, who is retiring after twenty years of service as president of the division.

Bee Chemical to Market Line Through Distributors

Bee Chemical Co., Lansing, Ill., an-



The building, located at 212 W. Monroe St., was formerly occupied by the Chicago office of the Federal Bureau of Investigation. The firm's former quarters were at 1820 W. Roscoe St., about four miles north of the Loop.

Powertron Ultrasonics Forms New Division

Powertron Ultrasonics Corp. has announced formation of a wholly-owned division, Powertron New England, successor to Industrial Ultrasonics, Inc., an independent distributorship absorbed by the company.

The new division is headed by *Theodore M. Jordan*, president. With headquarters at 68 Westfield St., West Springfield, Mass., Powertron New England will stock a complete line of ultrasonic cleaners and processing equipment.

Bick Elected President of Fidelity Chemical Products

Maurice Bick has been elected president of *Fidelity Chemical Products Corp.*, Newark, N. J., a major manu-



Arthur F. Kopisch

nounces the formation of a new division to market the company's water-based spray and dip coatings through distributors and manufacturer's representatives.

Arthur F. Kopisch has been named sales manager in charge of distributor sales. He will head national distribution of the product line through regional manufacturer's agents and distributors who now specialize in service and supplies to the electroplating field.

Until his recent appointment, Mr. Kopisch was responsible for sales of the products in the Chicago area.

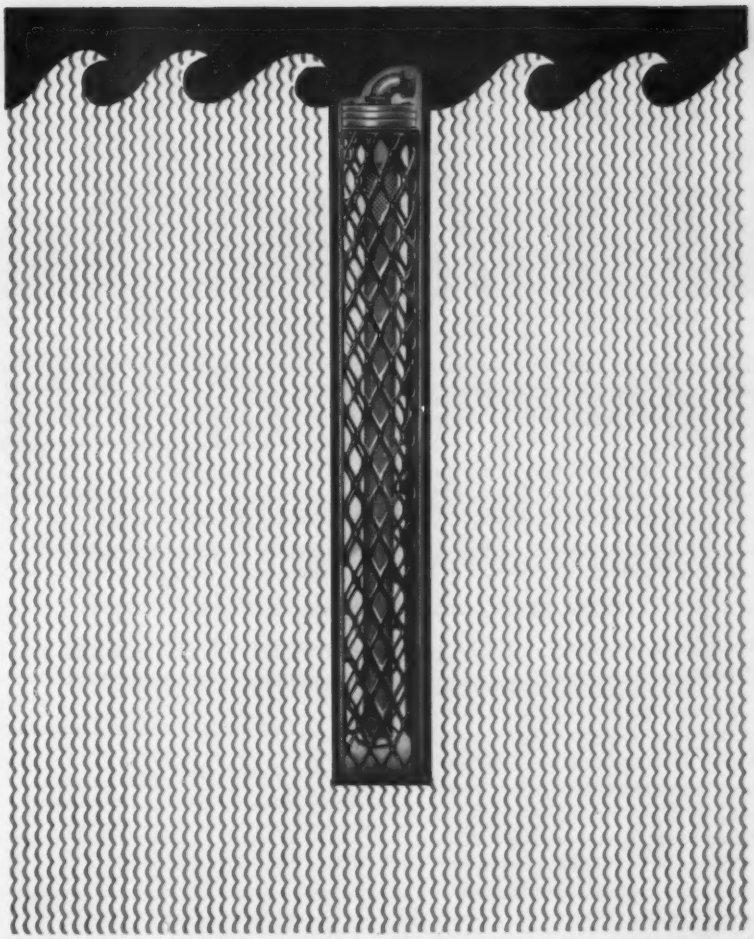
M&T Names Two To Detroit Lab Posts

Arthur J. Tomson and *Timothy P. Flynn* have joined the staff of *Metal & Thermit Corporation's* Electroplating Division, Detroit research facilities. The appointments were announced by *R. W. Couch*, manager of the Detroit laboratory.

Mr. Tomson comes to the firm after ten years at the Detroit Institute of Cancer Research, where he worked in organic synthesis. He received his education at Wayne University, where he was also employed for a year and a half as a microanalyst. A member of the American Chemical Society, he has published more than a dozen papers on organic synthesis and chemotherapy. He joins the company as a research chemist and will be engaged in research on electroplating additives.

Mr. Flynn, a native of Kaukauna, Wis., holds a B.S. degree from St. Norbert College, DePere, Wis. and an M.S. degree in inorganic chemistry from the University of Detroit. In this, his first professional affiliation, he will be engaged in fused-salt electrolysis and electro-organic research with the company's pioneering research group.

He is a member of the American Chemical Society.



For advanced ideas in immersion heating . . . N. J. THERMEX

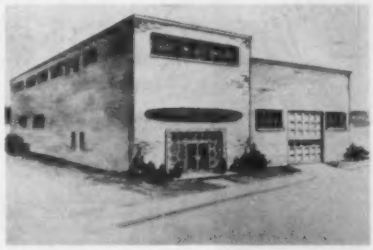
An exciting new concept in industrial immersion heating is now a reality. Write immediately for specific details explaining the modern principles and advantages of THERM-X-RED Immersion Heaters.

N. J. Thermex Company, Inc. • 535-533 Bergen Street, Harrison, New Jersey

General Vacuum Corp. in New Location

General Vacuum Corp., formerly located in East Boston, Mass., has moved to a modern new multi-story building at 81 Hicks Ave., Medford, Mass. The manufacturing area includes a high-bay area equipped for assembly and test of very large systems.

The new plant, with about 12,000



sq. ft. of manufacturing, engineering, and research space, meets the immediate needs, and there is a planned expansion to double the area.

Five New Executive Posts Filled at Pall Corp.

Pall Corporation, Glen Cove, N. Y., has announced a realignment of execu-



Sidney Krakauer | Henry Petronis | Joseph A. Whitwell | Charles H. Hacker | John A. Farris

tives to fill five new posts in the company and its divisions. Following are the new positions and those named to fill them:

Sidney Krakauer, vice-president, has become president of Fibrous Glass Products, Inc. with responsibility for all glass fiber operations.

Henry Petronis, vice-president-manufacturing, has taken on the added duties of president of Hollinger Machine Co., Ltd., Montreal, Que., manufacturer of water treatment equipment.

Joseph A. Whitwell, formerly vice-president-sales, has been elected vice-president-sales development, and will devote his efforts to new products.

Charles H. Hacker, formerly chief engineer, has been named general manager of Micro Metallic Division, which produces industrial filtration equipment.

John A. Farris has been promoted to manager of sales and engineering liaison for Aircraft Porous Media, Inc., leading supplier of filters to the aerospace industries.

Archer-Daniels-Midland Co. Promotes Ramseyer

Appointment of *Donald S. Ramseyer* as manager of engineering services for Archer-Daniels-Midland Company was announced recently. In his new position, he will be responsible for all of the company's engineering functions.

Since last August, Ramseyer has been in charge of construction of the new chemical center at Peoria, Ill. Prior to that he was vice-president and business manager of Applied Radiation Corp., Walnut Creek, Cal.

Ramseyer joined the company in 1957 when it acquired the soybean processing facilities of the Drackett Co. in Evendale, Ohio, where he was vice-president in charge of manufacturing and engineering. He is a graduate of Detroit Institute of Technology.

Clark, Pennsalt Vice-President, Retires

Lee H. Clark, Group Vice-President-East, *Pennsalt Chemicals Corp.,* has retired after 32 years of combined service with Pennsalt and with Sharples Chemicals, Inc., before the latter became a part of Pennsalt in 1951. He served as president of the Sharples firm prior to the consolidation. In 1955, he was appointed vice-president in charge of Administrative Services; and in 1960 he was named Group Vice-President-East, responsible for Chemical Specialties, Industrial Chemicals-East, and International operations.

A chemical engineering graduate of Cornell University, Clark was employed by the National Sugar Refining Co. and the General Chemical Co. prior to joining Sharples as a chemist in 1920. He holds various United States and foreign patents related to purification of oils, chemical processes and application of centrifugal machinery to industrial and process work, and is also the author of a number of articles on chemical processing.

He is a member of the American Chemical Society, the American Institute of Chemical Engineers and the American Management Association.

New Representatives and Offices for Atlas Mineral

The *Atlas Mineral Products Co., Inc.,* Mertztown, Pa., has announced the opening of two new sales offices and the appointment of two new representatives.

Thomas B. Cardene will become technical sales representative at one new office at 521 E. Main St., Richmond, Va. He was formerly in the Cincinnati sales territory and, in his new position, will serve the states of Virginia, North Carolina and eastern Tennessee and the District of Columbia.

Dallas W. Cann becomes technical sales representative at the other new office at Room 208, 312 E. Wisconsin

DEPENDABLE PPI PRODUCTS

RUBBER AND PLASTIC DRUM LINERS
MONEL, STEEL, COPPER AND TITANIUM ANODE HOOKS
PLASTIC COATED PAILS AND DIPPERS
POLYETHYLENE TANKS AND PAILS
TITANIUM ANODE SCRAP SAVER BASKETS
TITANIUM HEATING COILS
TRICHLORETHYLENE
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SWIMMING POOL CHEMICALS
OIL ABSORBENT
ACID TANKS AND CONTAINERS
HAND CHEMICAL PUMPS

NEW • DURABLE • LIFETIME

PPI TITANIUM ANODE HOOKS

This New Titanium Anode Hook Is Almost Indestructible When Used With — Nickel, Chrome, or Acid Copper Plating Solutions

Advantages that will save you money . . .

- No chemical or electrochemical attack on titanium hooks by plating solution
- No foreign metal to contaminate solution from the titanium hooks
- Titanium hooks can be placed completely under plating solution level . . . thus, minimizing scrap loss
- Hook threads will not decompose in plating solution
- No electrolysis on the surface of titanium that is exposed to the solution; therefore, hooks will not generate gas or decompose brighteners

NOTE: Titanium metal cannot be used in fluoborate solutions

Titanium Anode Hooks are made of 3/8" square stock in 3½" thru 8" graduated lengths to fit 1½" dia. anode rod size or less. Special size hooks quoted upon request. PPI makes a complete line of anode hooks . . . Write today for prices and complete details.



PATENT PENDING

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

Ave., Milwaukee, Wis. He will cover the state of Wisconsin.

Landes, Zachary and Peterson Co., with offices at 2501 South State, Salt Lake City 15, Utah, were appointed industrial sales representatives for the Mountain territory, consisting of Utah, southern Idaho, eastern Nevada and western Wyoming.

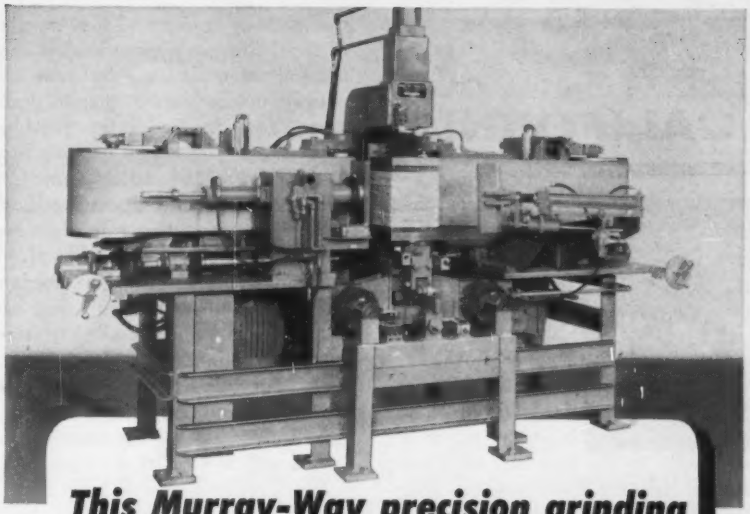
The *George F. Heath Co., Inc.* with offices at 430 Chouteau Ave., St. Louis 10, Mo. and a branch office in Kansas City, was appointed industrial sales representative of the midwestern territory which includes Missouri, Kansas, Nebraska, southern Iowa and southern Illinois.

Leon J. Barrett Co. Appoints New Sales Representative

A new sales representative to serve the Philadelphia-Baltimore area for the *Leon J. Barrett Co.* of Worcester, Mass., will be *William T. Day* of *The Day Engineering Co.*, King of Prussia, Pa. He will be assisted by *Joseph T. Thayer, Jr.* of the same company.

Chemical Products Appoints Two Directors

Hugh B. Allison and *Joseph S. Hawes* have been elected to the board of directors of *Chemical Products Corp.*, Providence, R. I. Mr. Allison joined the firm in 1948 and has served since 1957 as vice-president in charge of Chem-o-sol sales, responsible for the company's line of industrial PVC coating, molding and gasketing materials. Mr. Hawes has been with the company since it absorbed the New England Lacquer Co. and, in 1957, was appointed vice-president in charge of Nelco lacquer sales, handling textile, electrical and metal coatings produced by the company.



This Murray-Way precision grinding equipment completely eliminated a chronic scrap problem—paid for itself in a few weeks!*

This is just one of many examples of how Murray-Way engineering experience and equipment have helped manufacturers meet and beat today's tough competition. They can help you too.

Murray-Way has a complete line of cost saving equipment for automatic polishing, buffing, grinding, roll-coating, filtering, loading, unloading, conveying, and completely automated production lines.

Let our experienced engineers help you hold your competitive position.

*Details on request.



MURRAY-WAY CORPORATION

P. O. BOX 180, MAPLE ROAD EAST - BIRMINGHAM, MICH.



Hugh B. Allison



Joseph S. Hawes

Lau New Manager of Binks' Customer Demonstration Dept.

Appointment of *George Lau* as manager of the Customer Demonstration Dept. has been announced by *Binks Mfg. Co.*, Chicago. He has been with the firm for five years, as assistant manager of the electrostatic spray painting equipment department, and as a customer service representative in the automatic equipment department. Prior to that, he worked for 12 years in the field of spray painting equipment. He is familiar with all types of spray painting equipment and systems.

NEWS FROM CALIFORNIA



The Department of Industrial Relations, Division of Apprenticeship Training, State of California, has issued a booklet of apprenticeship standards for the plating industry, which are applicable to the recently established Plating Industry Apprenticeship Training Course which opened in February in Van Nuys, Calif., as well as to other similar courses which may be set up elsewhere in the state.

The booklet explains the purpose of the training course, how and by whom it is directed, and sets forth standards to which employers, employees and apprentices must adhere. The course is directed by a Joint Apprenticeship Committee consisting of four members of the California Apprenticeship Council, and seven plating shop owners operating in the San Fernando Valley area. *Ted I. Goodman*, president, Michael Rand Plating Co., Van Nuys, is chairman of the plating council.

Duties of employers are specifically defined, and state that employers must see that all apprentices are employed, registered, and trained in accordance with the State standards; that each apprentice must be provided with reasonably continuous employment, and must be assigned to work that will give him diversified experience and training in all phases of the trade, on the job as well as in related instruction.

Every apprentice must be at least 18 years old and must enter into a written apprenticeship agreement after having met the committee's requirement on eligibility.

The standards provide that the term of plating apprenticeship shall be 6,000 hours, the first 500 hours of which shall be a try-out or probationary period. The following apprentice wage schedule is provided:

1st 1,000 hours, $1.65 per hour
2nd 1,000 hours, $1.80 per hour
3rd 1,000 hours, $1.90 per hour
4th 1,000 hours, $2.05 per hour
5th 1,000 hours, $2.25 per hour
6th 1,000 hours, $2.50 per hour

The above rates compare with the present plater's journeyman wage of $2.75 per hour.

Apprentices must satisfactorily complete a course of not less than 144 hours per year of related and supplemental instruction. Time spent in related instruction is non-compensated. A qualified employer may employ one apprentice when he has at least one journeyman regularly employed, and one additional apprentice for each additional journeyman.

The major work processes in which the apprentice must be trained, although not necessarily in the order listed, and the approximate hours to be spent on each, are specified in the standards as follows:

WORK PROCESS — APPROX. HOURS:

A. Wiring, unwiring, drying, loading and unloading, cleaning and pick-

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USE **TRUE BRITE BRASS SOLUTIONS**

Trouble Free — Low Cost
Little Supervision Needed
Ready To Use — Just Add Water
Uniform Color — Can Match Colors

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Better Buffing and Polishing?
ANSWER: ALWAYS USE
FORMAX COMPOUNDS



Formax manufactures a complete line of Buffing and Polishing Compounds in bar, tube and liquid form suitable for all classes of metal, plastic and lacquer finishes. Formax compounds used together with the famous Formax ZIPPO long wearing buffing wheels make a combination that's hard to beat. Our extensive manufacturing, laboratory and testing facilities are always at your disposal.

Descriptive Catalogs Available on Request.

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DETROIT 7, MICHIGAN
"THE FOUR McALEERS"

ling tanks; loading and unloading plating tanks. Rinsing operations, wire, racks, baskets, rubber gloves — 1,000 hrs.

B. Scratch brushing, acid dipping. Tools and instruments used: Voltmeter, ammeter, etc. — 1,000 hrs.

C. Still tank or barrel plating of common metals: (tools and devices: tank rheostat, clock, ammeter, voltmeter). Must acquire skill in adjusting and regulating rheostat — 1,000 hrs.

D. Precious metal plating: (Tools and devices used: tank, rheostat, ampere hours, determining proper thickness) — 1,000 hrs.

E. Engineering plating and special chemical processes: (tools and devices used: tank rheostat, micrometer, voltmeter and clock, etc.) — 1,000 hrs.

F. (1) Mixing formulas for cleaning, pickling, acid dipping and plating solutions. (2) Acquiring electrochemical knowledge and experience required for all around electroplating — 1,000 hrs.

The California State standards provide that overtime hours, or time spent in excess of standard 40-hour work week, shall not be creditable hours of training. Each apprentice must maintain a record of the time spent by him on each work process and in related and supplemental instruction. During the probationary period, apprentice agreements may be terminated by the Joint Apprenticeship Committee at the request of either party. After such probationary period, apprentice agreements may be terminated by the administrator of apprenticeship by mutual agreement of all parties, or cancelled by the administrator for good and sufficient reason.

The *Carborundum Co.* and its subsidiary, *Pacific Abrasive Supply Co.*, which formerly operated separate office and warehouse facilities in the Los Angeles area, have moved their offices and stocks to a new $1-\frac{1}{2}$ million abrasive service center at 2240 South Yates Ave., Los Angeles, Cal.

Inventories include a complete line of abrasives running the full range of bonded abrasives such as grinding wheels, abrasive grains and powders, tumbling media and compounds, coated abrasive sheets, rolls, discs and belts. In addition, the Abrasive Service Center stocks a complete line of cutting tools, coolants, super refractories, electrical components, barrel finishing machines, and abrasive belt machines.

Cowles Chemical Co., Cleveland, Ohio, has appointed *Harshaw Chemical Co.* exclusive distributor in Southern California. Headquarters for this new operation will be the latter's Los Angeles office.

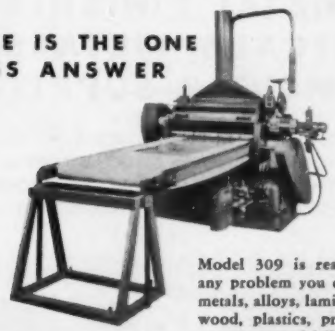
Harshaw's distribution in areas other than Southern California will not be affected by this new arrangement, and Cowles will support sales efforts with a full time resident technical representative.

H. W. Medalie, formerly West Coast sales representative for Bogue Electric has joined *Rapid Electric Co.* as district sales manager of industrial power equipment. He will also act as technical advisor for the L. H. Butcher Co.

From RUST Removal to final FINISH

On Sheet or Coil Stock

HERE IS THE ONE PASS ANSWER



Model 309 is ready for almost any problem you encounter with metals, alloys, laminated surfaces, wood, plastics, printed circuitry . . . you name it! For coarse stock removal, satin finishes, mirror surfaces, polishing, brushing, waxing, etc. It's a pinch-roll, thru-feed unit.

CLAIR ONE OF 11 MODELS OF CLAIR SURFACE FINISHING MACHINES

MANUFACTURING CO., Inc., OLEAN, N.Y.

Offering the Most VERSATILE Line of Surface Finishing Machines

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ATTENDING
THE NATIONAL AES CONVENTION
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Haskell W. Medalie

A graduate of Fordham University, New York, (BSEE) and the University of West Virginia, Mr. Medalie brings 13 years of specialized training in sales of dc power supplies to militarized aircraft and missile development programs.

He is a member of both the IRE & ISA.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Blue Ridge Branch

The branch held its regular monthly meeting April 7, at the Tropicana Steakhouse in Greensboro, N. C. Twenty-six members and guests attended. *Bruce Wallace,* branch president, presided over the meeting.

The nominating committee has selected a slate of officers for 1961-1962. Those nominated are: *Mike Milo,* Western Electric Co., president; *Carl Witherspoon,* Poly Scientific, 1st vice-president; *Roy Lewis,* Metal Finishing Co., 2nd vice-president; *Donald McGee,* Bassick-Sack, secretary-treasurer. Those nominated for the board of managers are *Bruce Wallace, Dr. Nelson Murphy* and *Walter Conine.* Elections will be held at the May meeting. Three new members were elected. They are: *Dan N. Barber, Harold J. Coates,* and *W. A. Saunders.*

After the business session those attending heard *Dr. John A. Stevens,* Dow Chemical Co., talk on "Finishing of Magnesium."

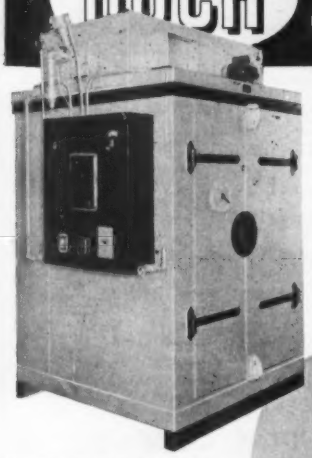
Donald H. McGee,
Secretary

Buffalo Branch

The Branch held its monthly meeting Friday, April 7, at the Niagara Manor Restaurant, Buffalo, N. Y. There were 24 members in attendance. Following roll call of officers and treasurer's report, the secretary read a letter from *Frank Beuckman,* National 3rd Vice-President advising he will be present at the installation of new Buffalo Branch officers to be held May 12, 1961.

President *Harold Shapiro* advised he has tickets available for the forthcoming Industrial Science Fair to be held in Buffalo and advised all to attend. *John Donaldson,* chairman of the membership committee stated the Buffalo Branch has succeeded in attaining its 10% increased membership goal.

KOCH SHELF OVENS



A complete line of ovens for industry pre-engineered, packaged, ready for installation.

- factory assembled
- to NBFU regulations
- gas, electric, steam
- accessory equipment is available

KOCH SHELF OVENS, in addition to being designed for conventional drying, baking, and curing processes, are used for special operations . . . plastic pre-heating, selenium rectification, etc. KOCH ovens are completely assembled and tested prior to shipment.



Please wire or write for Koch engineering services. No obligation.

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BUFFS • POLISHING WHEELS • COMPOSITIONS • ANODES • HEAT TREATING PRODUCTS • COATED ABRASIVES • CLEANERS

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Roland Campbell reported on the recent Regional Board meeting relative to the proposed by-laws governing Regional Conventions. Mr. Campbell advised most of the other Empire State Regional Branches were opposed to the proposed by-laws, as was Buffalo. A particular question was the $500 fund to be set up as insurance against Act of God catastrophes that result in host branches becoming financially embarrassed. A motion was made, seconded and carried by a close vote that Buffalo will not support the proposed fund.

A committee consisting of *Richard Davis, George Wolf* and *Ray Blechinger* was appointed to find a new meeting place for the 1961-1962 season. It was felt that this move may stimulate new interest for those members not attending meetings.

Chuck Fotheringham, chairman of the nominating committee, presented the following slate of new officers for the 1961-1962 season:

President — *John Donaldson.*
1st Vice-Pres. — *Richard Davis.*
2nd Vice-Pres — *John Tiebor.*
3rd Vice-Pres. — *Mat Hayes.*
Secretary — *Robert Eich.*
Librarian — *George Wolf.*
Treasurer — *Melvin Stachura.*
Board of Managers — *Harold Shapiro, Roland Campbell, John Scholterer.*

Following the nominations, the candidates were duly elected to office.

Daniel Stachowiak was appointed chairman of the new finance committee to create interest in the Buffalo industrial area to obtain additional sustaining memberships.

Librarian Tiebor opened the technical session with questions from the question box and from the floor. Those in attendance who presented metal finishing problems were well satisfied with the discussions and answers received.

Robert C. Eich,
Secretary

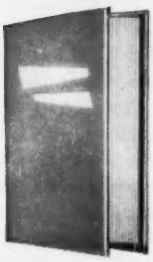
Capitol District Branch

An event that was outstanding in the history of the Branch took place Monday evening, April 3. With the excellent cooperation of the officials and personnel of the U. S. Army Arsenal at Watervliet, N. Y., a dinner meeting was held in the restaurant of the Arsenal, followed by a guided tour of the metal finishing departments on the post.

More than forty members and friends of the Mohawk Valley Branch, at Utica, N. Y. and surrounding area, joined on this occasion. The total attendance count showed that some 96 men who are active in or associated with plating in upper N. Y. State and New England, made the trip to Watervliet for this evening from points as far away as Syracuse, Johnson City, North Adams, Mass. and elsewhere, with a few coming from Connecticut.

During the social hour preceding the dinner, the Officers' Club did an excellent job of keeping the jovial visitors in the best of "spirits." The official host for the evening was Past President *Bob Hill,* supervisor of Industrial Finishes Section, Research and Engineering Division at the Arsenal, assisted by his staff members, *Ted Pochily* and *Pete Greco.* These men did an outstanding job of conducting the tour,

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explaining the operations and answering questions.

Following the fine turkey dinner served by the Arsenal cafeteria department, we were shown the new installation recently put into operation for hard coat anodizing of aluminum. The assemblage was then divided into two groups and alternately shown (1) the facility for hard chrome plating large calibre gun tubes, and (2) the newer operation for heavy deposition of nickel on gun tubes for salvage purposes.

W. Robert Wolf,
Librarian

Los Angeles Branch

The Branch held its 30th annual educational session and dinner dance at the Statler-Hilton Hotel in Los Angeles on Saturday, April 8.

Attendance at the technical session, which was conducted from 9 a.m. till 1 p.m., was approximately 125, at the mid-day luncheon 150, and at the dinner dance in the evening, 450 members, guests, and their ladies. The affair took on some of the aspects of a regional session, due to the presence of a number of members from San Francisco and Phoenix branches, and all the officers, board members, and various individual members of the new San Diego Branch.

The morning technical session was addressed by three outstanding speakers from the eastern area of the country. They were *Dr. Frederick A. Lowenheim* of Metal & Thermit Corp., Rahway, N. J.; *Edward C. Rinker* of Sel-Rex Corp., Nutley, N. J.; and *Lawrence J. Durney*, Enthone, Inc., New Haven, Conn.

Mr. Rinker presented a talk on "Space Age Precious Metal Plating," which he illustrated with various slides to show how the additives in the solution affect the precious metal deposit, particularly in respect to increasing hardness.

Dr. Lowenheim discussed "Alloy Plating." He began his presentation by explaining the reasons for alloy plating. The speaker also discussed the relative merits and drawbacks of plating tin-zinc alloys, tungsten, molybdenum, bronze-gold and cadmium. In the conclusion of his talk he discussed the various uses of alloy plating and the solderability of tin-alloys.

Mr. Durney presented an illustrated talk on "Electropolishing." He discussed the general phases of this type of polishing and related the progress the technique has made in recent years.

Question and answer periods were moderated by *Don C. Baudrand* at the conclusion of each talk.

Kenneth Johnson served as toastmaster at the mid-day luncheon at which all technical talks were tabooed. Instead, the members and guests of the branch were brought up-to-date on how the new Los Angeles American League baseball team hopes to make out in the big league race which was to open the following week.

The main ballroom of the Statler Hilton Hotel was the scene of the Branch's annual dinner dance in the evening. Dinner was followed by dancing to the tunes of Carroll Wax's orchestra till 1 a.m. *John Millhorn* (originator of this feature eight years ago) again presided over the annual waltz contest, during which members of all ages and their ladies competed for several beautiful trophies donated by the Kaag Mfg. Co., of Los Angeles.

William Thomas served as general chairman of the day's events. His assistants included *Burt Adams, Barrie Blackburn, John Millhorn, Gene Weiner, Don Baudrand, Kenneth Johnson, Dan Ross, Harold Zagorin, Harold Wanamaker, William Pardee*, President *Frank Virgil* and President-Elect *Emmett H. Babcock*.

Dayton Branch

During the regular April meeting at the Biltmore Hotel on April 19, President *Byron Bowman* announced that a Monte Carlo Party will be held on June 3 at the Delco-Moraine Recreation Center.

It was reported that the executive board had carefully reviewed the proposed Constitution changes listed in the current issue of *Plating*. They favored all except the change in dues, to which there was unanimous opposition. The Branch voted to instruct the delegates accordingly.

The speaker of the evening, *James West*, field engineer for the F. S. Stokes Corp. of Philadelphia, was introduced by Branch Librarian *Walter Anderson*. Mr. West discussed "Vacuum Metalizing" in a very informative manner and illustrated his presentation with numerous colored slides.

The next meeting will be a dinner meeting at Kuntz Cafe on May 17. Election of officers for the next fiscal year will be followed by a talk on "Organic Finishes" by *Dr. Fenburr* of Hanna Paint Co., Columbus, Ohio.

L. A. Critchfield,
Public Relations Chairman

Chicago Branch

On Saturday evening, April 8, the annual "Ladies-Nite" was held at the Lilac Lodge in Hinsdale, Ill. The gals were treated to cocktails and the mem-

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bers had a choice of a chicken or ham dinner. After the excellent dinner, *Joe Andrus*, chairman, introduced the officers and members of the board of managers for the coming year. The officers are President, *Rudy Hazucha;* 1st Vice-President, *Joseph C. Corre;* 2nd Vice-President, *Art Bartman;* Secretary-Treasurer, *Paul Glab;* Librarian, *Charles Geldzhaler*. The board of managers are *Matt Dassinger*, Chairman, *Robert Waits, Charles Jensen, Williard Carter*, and *Christopher Marzano*.

The program for the evening was a talk by *Samuel Becker*, "Russian Side-Lights" illustrated with colored slides. The slides depicted the cultural and agricultural life of Russia and was a very interesting talk and Mr. Becker answered many questions.

Christopher Marzano,
Publicity Chairman

Miami Branch

The meeting of April 21, held at the Parc, was chaired by *Earl Kennedy*. The following were presented as the slate of officers for the year 1961-62 and *Fred Fulforth*, as chairman of the nominating committee, presided at the election. President. *Earl Kennedy;* 1st V.-P., *M. H. Dent;* 2nd V.-P., *Jack Craig;* Sec'y Treas., *Charles Posner;* Librarian, *Anthony Rotoli;* Board of Managers, *Charles Posner, M. H. Dent, Walter Donnelly, Rolla Taylor;* Delegates. *M. H. Dent, Fred Fulforth, Stephen Putzan;* Alternates, *Charles Posner, Earl Kennedy, Frank X. Marinello*. Those elected will serve for the Year 1961-62, the dates coinciding with the National Fiscal Year.

Dinner was made all the more pleasant when *Mrs. Stephan Putzan*, a surprise guest at the meeting, acted as hostess at dinner.

Plans for Ladies Nite are complete for the third Friday in May, at 6:30 P.M. There will be an educational program, along with other plans, and the ladies will see for themselves that the boys do not go to the meetings only for a night out.

The branch was invited to join the South Florida Council of Technical Societies. This invitation was accepted and *Jack Craig*, 2nd V.-P. elect, was appointed as the representative of the AES. *Anthony Rotoli* will represent the AES at the meetings of the local ASM.

The speaker of the evening was *David Miller*, technical field representative of the Deering Milliken Buff Cloth Program. He traced the growth of the need for special Buff cloths and the progress being made in that field from about 1920 to the present. The color film, "Cotton — Natures Wonder Fibre," was most enlightening.

Abe Schorr,
Secretary

Newark Branch

President *Al Korbelak* called the April 21st meeting to order at 8:30 p.m. with about 90 members and guests in attendance. Since it was Ladies' Night, about 40 members brought their wives to the meeting.

The Branch was indeed honored by the presence of *Dr. Ernest Raub* from Germany and *Dr. Karl Schumpelt*, formerly of Germany. They were discussing plating problems at Sel-Rex Corp. prior to coming to the meeting.

One application for membership was received and four were elected to membership. They were Messrs. *J. R. LoMonte; G. E. Grimm* from E & H Metal Finishers, Inc.; *J. J. Clarke* from Jun Chemical Co. and *S. Aguiar* from Thermo-Electric Co. One transfer which proved to be a very pleasant surprise was *Dr. R. A. Schaefer* from the Toledo Branch. *Howard Cobb*, Past President and one who has contributed much of his time and effort to the Branch, was elected to Honorary Membership.

Having dispensed with the business, the meeting was turned over to *Paul Oldam*. He amused us for about a half hour with his tricks of magic. Following this, Al Korbelak showed us slides of his recent trip to Japan, Australia and Hawaii. He presented his slides in an interesting and informative manner.

Paul Oldam then presented the Jarrets, mentalists, who spent the next half hour reading our minds, predicting the future and performing the arts of legerdemain. After this, both Al Korbelak and *Don Foulke* presented door prizes to the lucky ladies. At the conclusion of the meeting we partook of a light refreshment and renewed acquaintances.

Gustav Bittrich,
Assistant Secretary

New York Branch

April 14 was "Old Timers Night," and the meeting was called to order by President *Joseph Rembecki*. A motion made and carried that an application for membership from *Anthony Ciccotelli* follow regular course. Messrs. *Aracelo Garcia, Hal Curtis Felsher* and *William Venturini* were accepted as members and duly sworn in by President Rembecki.

All further business was dispensed with. *Dr. Donald G. Foulke* of the Newark Branch and well known in the Society installed the officers for the coming year as follows:

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2nd. Vice-Pres. — *Isidore Friedman.*
Fin. Sect. — *Daniel Paris.*
Rec. Sect. — *Fred Saras.*
Librarian — *Walter Schwartz.*
Sgt. at Arms — *Charles Weiner.*
Sect. Treasurer — *Milton Nadel.*
Bd. of Managers — *Joseph Rembecki.*

Mr. Nadel presented out-going president Rembecki a past-president pin and a gold wrist watch for his services to the branch.

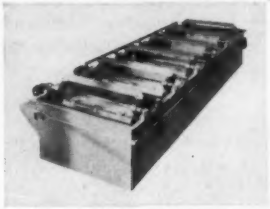
Dave Clarin was presented with a beautifully engraved plaque, due him from the "Dave Clarin Night," for his work on the Branch and National Society.

Milton introduced all members who have been with the Branch over twenty five years. He praised them for their work at the local and national levels. The senior member, *Justus E. Stremel,* is one of the founding fathers of the Society. All the Old Timers had a word of praise for the Branch and urged the members to take active parts and keep the Branch on top.

After the speeches by the old timers and other members honoring them, the meeting was adjourned. After the meeting, refreshments and a magnificent buffet with light entertainment were offered.

Fred Saras,
Recording Secretary

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Waterbury Branch

The Branch held its regular meeting at the Roger Smith Elton on Thursday April 13. President *William Giesker* announced that the 22nd New England Regional Meeting is entirely sold out. Approximately 200 people will represent the Branch.

The branch initiated *Louis S. Beres, Jr.* and presented him with a certificate of membership. The program to present lectures to local schools has gotten under way. The first such lecture was presented by *Henry Strow* at the Swift Junior High School in Watertown. *Edward Garland* presented the second lecture at the Naugatuck High School.

The following members were nominated for office:

President — *Louis Porretti.*
1st Vice-Pres. — *Patrick Mazzamaro.*
2nd Vice-Pres. — *Francis A. Schneiders.*
Librarian — *Clarence Foster.*
Secretary-Treasurer — *James Kennedy.*

Technical Chairman *Francis Schneiders* introduced the speaker of the evening, *Dr. Walter Meyer,* who presented an excellent paper on "Hazards in the Plating Room." He discussed the causes of serious accidents, explosions, fires that have occurred in plating rooms and other potential hazards. Dr. Meyer actually performed experiments showing the combustible nature of many materials and the dangers of mixing oxidizing and reducing materials.

Francis A. Schneiders.
Publicity

NATIONAL TECHNICAL TASK COMMITTEE ON INDUSTRIAL WASTES

A successful meeting on research in the area of industrial wastes and water usage was held April 11-12 in Cincinnati. Some sixty-five scientists and engineers concerned with industrial wastes met at the Robert A. Taft Sanitary Engineering Center to listen to reports on research progress. Of interest to the plating industry was the report on "Determination of Water Quality Requirements for Protection of Aquatic Life" by *C. M. Tarzwell,* who stated that hydrocyanic acid, not the complex cyanides, was toxic to fish, and that an analytical method had been developed for the determination of undissociated HCN. *Bernard Berger,* chief, Research Branch, reported considerable contract research will be let out by the Center and *R. Holtje* reported that more money would be available as research grants under the Public Health Service.

G. N. McDermott reported that copper cyanide reduced the efficiency of activated sludge treatment more than copper sulfate. This work is almost completed, after which the effect of nickel will be studied. Hexavalent chromium, short of massive slug doses, is unlikely to harm the operation of a sound sewage treatment plant. The retention of the chromium is primarily in the activated sludge solids and a digestor with 3.5 per cent chromium in the sludge solids performed satisfactorily.

In view of the exploding population and rocketing industrial growth, water use will increase tremendously in the next fifteen years. This means greater reuse by recycling and by better treatment, so that effluents can be used time and again. The Center is embarking upon a program of advanced waste treatment research with the objective of solving such problems as removal of organics, minerals, and solids by an imaginative, progressive approach.

The NTTCIW in a brief business session passed resolutions 1) recommending a continuing study of the application of stabilization ponds to sewage and industrial waste treatment, 2) reaffirming past support of the need

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*3.6-5.0 pH	8.6-10.0 pH
*2.4-3.9 pH	10.1-11.3 pH
1.0-2.8 pH	10.5-13.0 pH
0.4-1.4 pH	11.0-13.1 pH

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for increased research and 3) recommending that consideration of permissive legislation permitting one-year tax write-off of the cost of industrial waste disposal installations.

D. Gardner Foulke,
Vice-Chairman

Manufacturers' Literature

Abrasive Wheels

Merit Products, Dept. MF, 3691 Lenawee Ave., Los Angeles 16, Cal.

A new Technical Data Sheet, No. FD-30, amply illustrated, discusses features and applications of Type B Flex Drum, a super-resilient abrasive cloth wheel that simplifies sanding and polishing complex contoured surfaces. The brochure lists grit grades available and describes the various configurations of the drum. In addition, it covers rotation speeds and abrasive loading procedures.

Automatic Ultrasonic Cleaning Unit

National Ultrasonic Corp., Dept. MF, 95 Park Ave., Nutley, N. J.

Bulletin No. 7 describes a new automated printed circuit cleaner system, designed for production cleaning, with "Freon" and ultrasonic energy.

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Titanium Mesh Anodes

Sel-Rex Corp., Dept. MF, Nutley, N. J.

"Platinum-ized" titanium mesh anodes, trademarked Platanium, are described in a new booklet. The illustrated technical data suggest uses and applications for this type of insoluble anode, and basic sizes, shapes, and types of anode hooks available, with corresponding prices, are given in the booklet.

Aluminum Processing

J. B. Ford Div., Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

A 4-page folder covers etching, cleaning, desmutting, paint stripping, barrel finishing, brightening, paint preparation, deoxidizing.

Featured products include Mil-Etch for decorating etching and Aldet, a new non-silicated companion product for cleaning prior to etching.

Side-Opening Electroplating Filters

Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

A four-page illustrated brochure lists specifications of each side-opening filter, built for easy maintenance and maximum removal of contamination from all kinds of plating solutions and the efficient filtration of many other liquids. Special models are engineered and constructed to individual specifications.

High Speed Chrome Plating Anodes

Heil Process Equipment Corp., Dept. MF, 12850 Elmwood Ave., Cleveland 11, Ohio.

Bulletin No. B-4660 gives a complete description, including prices, of four diameter sizes and thirty standard lengths of anodes for high speed chrome plating employing the new HS-32 lead alloy for use with the new high speed fluoride-ion chrome plating solutions.

Ultrasonic Cleaning Units

Acoustica Associates, Inc., Dept. MF, 10400 Aviation Blvd., Los Angeles 45, Cal.

A bulletin describing a new self-tuning, transistorized 20-KC line of ultrasonic cleaners elaborates upon the unit's advantages over older vacuum tube systems.

Paint Masks

Conforming Matrix Corp., Dept. MF, 780 New York Ave., Toledo 11, Ohio.

A new brochure describes and illustrates all of the various types of masks employed today in the rapid, accurately controlled, multiple color wet painting of mass-produced products.

Examples of line production spraying with these electroformed metal masks are pictured. Requirements for mask ordering are also detailed.

Metal Cleaner

E. F. Houghton & Co., Dept. MF, 303 W. Lehigh Ave., Philadelphia 33, Pa.

A new data sheet tells how to use Houghto Clean 220, an efficient metal cleaner which leaves a film that protects parts from rust during processing or in storage.

Chemicals for Ultrasonic Cleaning

Branson Instruments, Inc., Dept. MF, 40 Brown House Road, Stamford, Conn.

A 14-page booklet, Bulletin S-700 gives extensive information on physical properties of most commonly used cleaning chemicals, as well as suggested applications, working temperatures, and procedures.

Fourteen different types of cleaning

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Industrial Instruments

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June 10: Annual Golf Outing. Springfield Branch A.E.S., Whippernon Club, Russell, Mass.

June 10: Annual Ladies' Night Dinner Dance, Pittsburgh Branch A.E.S., Churchill Valley Country Club, Pittsburgh, Pa.

June 16-17: Annual Convention, National Association of Metal Finishers, Statler-Hilton Hotel, Boston, Mass.

June 18-23: 48th Annual Convention, A.E.S., Boston Host Branch, Boston, Mass.

June 25-30: Annual Meeting, American Society for Testing Materials, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

June 26-27: 5th Annual Conference on Vacuum Metallurgy, American Vacuum Society and New York University, Co-Sponsors, University Heights Campus of N.Y.U., New York City.

July 22: Annual Stag Day, Detroit Branch A.E.S., Glen Oaks Country Club, Farmington, Mich.

July 31-Aug. 4: Gordon Research Conference on Electrodeposition, Tilton School, Tilton, N. H.

Sept. 5-8: 11th National Chemical Exposition, Chicago Amphitheater, Chicago, Ill.

Oct. 1-5: Fall Meeting, The Electrochemical Society, Hotel Statler, Detroit, Mich.

Oct. 23-27: Metal Show and Congress, American Society for Metals, Cobo Hall, Detroit, Mich.

media are tabulated, divided into two main groups — aqueous solutions, and solvents. Accompanying technical information includes such useful data as concentrations, operating temperatures, safety handling measures, and proper uses.

Heat Exchanger

National Carbon Company, Dept. MF, 270 Park Ave., New York 17, N. Y.

An 8-page illustrated catalog on its new Karbate impervious graphite counterflow block heat exchanger, Type CFB, is available. The simple block construction that makes possible a range of heat transfer capacity is described, and the five different flow arrangements using single, three, and five passes are shown. Heat transfer area, and net, flooded, and shipping weights for the five available models are listed.

Zinc-Rich Protective Coating

Sealube Co., Dept. MF, 14 Valley St., Wakefield, Mass.

A new four-page brochure describes Z. R. C. (Zinc Rich Coating) and explains how it can be brushed or sprayed on iron or steel surfaces to provide galvanic (cathodic) protection against rust and rust creepage. The brochure pictures applications, and includes cost and coverage table.

Acid Inhibitors

O'Brien Industries, Inc., Dept. MF, 95 Dorsa Ave., Livingston, N. J.

A new, comprehensive brochure describes acid inhibitors. The new literature gives details as to recommended concentration of O'B-Hibit with various acids and suggested uses for the inhibitor in many fields.

Chromium Plating on Aluminum

Service Research and Development Co., Inc., Dept. MF, Route 22 and Greeley Ave., Union, N. J.

A four page, illustrated brochure describes the Chrom-Lume process for bonding hard chromium on aluminum alloy, and also lists the advantages of the method.

Rust Preventive

Rust-Lick, Incorporated, Dept. MF, 755 Boylston St., Boston 16, Mass.

Brochure No. 611 covers features, applications and packaging of Rust-Lick 606, a specially formulated spray-on, moisture-absorbing, lubricating mist which can be used on wet or dry surfaces, and which provides positive long-term protection against rust.

Plastic Coating

Pfaudler Co., Dept. MF, 1128 West Ave., Rochester 3, N. Y.

A four-page bulletin describes Pfaudlon 301, a medium priced, corrosion resistant plastic coating for metal. The new bulletin tabulates recommended service and typical equipment applications as well as basis metals to which the coating has been successfully applied. A complete list of physical characteristics is also included, as is a list of licensees who are authorized to custom coat existing equipment in the field.

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Selective Plating

Selectrons, Ltd., Dept. MF, 520 Fifth Ave., New York 36, N. Y.

A new 6-page bulletin, SP-201, on selective plating equipment describes several of the company's "package" plating plants, some of which are small enough to fit on a table top.

In addition to outlining the equipment, the bulletin also lists more than two dozen engineering applications for the process.

Chemical Specialties

MacDermid, Inc., Dept. MF, Waterbury 20, Conn.

Three new Metex products are described in usage and instruction sheets. Technical Data Sheet No. 116 covers Nickel Stripper BR, a dry powder for immersion stripping nickel from brass and copper. Anti-tarnish M-667, a liquid to be added to the final water rinse is described in Technical Data Sheet No. 124, and Chrome Reducer M-663, a liquid added to rinses following chromium plating to prevent yellow staining is detailed in Technical Data Sheet No. 123.

OBITUARY

A. C. FRICKE

A. C. Fricke, owner of the *A. C. Fricke Co.*, electroplating equipment distributors, died recently of a heart attack.



Mr. Fricke, a Dallas, Tex. resident for forty-four years, was secretary of that city's branch of the A.E.S. He was also a 32nd degree Scottish Rite Mason of the Gibraltar Masonic Lodge and a member of Hella Temple Shrine.

He is survived by his widow; two brothers, *A. R. Fricke* of Trenton, Mich., and *L. R. Fricke* of Ingleside, Texas; and three sisters, *Mrs. Leona Martin* of Meridian, *Mrs. Neal Terrill* of Clifton and *Mrs. Eleanor Fallis* of Freeport, Tex.

ABSTRACTS OF PAPERS

(Continued from page 72)

to oxidation, and plating thickness. The results of the tensile test proved to be statistically valid. From this it was found that some electrodeposited films produced stronger and more reproducible connections than other coatings.

Producing Ultra-High Frequency Electronic Parts by Electroless Copper and Precious Metal Plating on Plastics

By C. E. MacNeill,
The Martin Co.

A research program was conducted to evaluate the feasibility of producing ultra-high frequency electronic parts using electroless and precious metal plating on plastics. An optimum process was developed and the properties of plated parts evaluated. Typical electronic assemblies were fabricated using plated plastics to evaluate electronic characteristics. It was found that plated plastic parts could be substituted for plated metal parts to result in an improved end item.

NEW BOOK

The Practical Anodizing of Aluminum

By W. W. Hübner & A. Schiltknecht. Published by MacDonald & Evans Ltd., 8 John St., London, W.C.1, England. 1960. 330 pages, including bibliography and index. Price: 55 shillings.

The original German edition, published in 1956, was written for the anodizer rather than for the scientist. In this excellent translation by *Winifred Lewis*, the bibliography has been brought up to date, but there appears to have been no revision of the other material. Hard anodizing, for example, is given less than 1½ pages. The preoccupation of the authors with practice, on the other hand, has led to the inclusion of five pages on immersion heating and cooling alone, and almost ten per cent of the whole book deals with power supply and distribution, with wiring diagrams for such things as switch boxes, and series-parallel generators.

On the credit side however, can be mentioned the most complete and detailed chapter on racks and racking yet published, which even covers suspension by wires. Sections on tanks, auxiliary equipment, preparation, and pretreatment are exceptionally good, especially on mechanical polishing, in which the Germans are quite progressive. These sections alone would make the book a valuable addition to the finishing library. Every anodizer will find some pointers in the volume which will help to improve his process and, if an existing installation is to be modified, prior reading of the book is almost a must.

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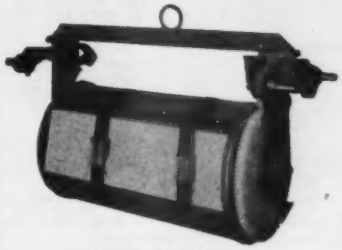
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Cohn Mfg. Co., Inc., Sigmund 54
121 S. Columbus Ave., Mt. Vernon, N. Y.

Columbia-Southern Chemicals, Chemical Div., Pittsburgh Plate Glass Co. 42, 43
One Gateway Center, Pittsburgh 22, Pa.

Conversion Chemical Corp. 108
100 E. Main St., Rockville, Conn.

Cowles Chemical Co. 47
12000 Shaker Blvd., Cleveland 20, Ohio

Crown Rheostat & Supply Co. 11
1965 Pratt Blvd., Elk Grove Village, Ill.

Davies Supply & Mfg. Co. 32
4160 Meramec St., St. Louis 16, Mo.

Davis-K Products Co. 128
135 W. 29th St., New York 1, N. Y.

DeVilbiss Co., The 29
Toledo 1, Ohio

Diamond Alkali Co. 10
300 Union Commerce Bldg., Cleveland 14, Ohio

Dixon & Rippel, Inc. 136
Box 116, Saugerties, N. Y.

Dow Chemical Co., The (Saran Lined Pipe) 23
2415 Burdette Ave., Ferndale 20, Mich.

Dura-Brite Chemical Products, Inc. 105
P. O. Box 82, Farmingdale, L. I., N. Y.

Enequist Chemical Co., Inc., The 50
100 Varick Ave., Brooklyn 37, N. Y.

Enjay Chemical Co., Div. of Humble Oil & Refining Co. 36
15 W. 51st St., New York 19, N. Y.

Enthone, Inc. 3
442 Elm St., New Haven 8, Conn.

Federated Metals Div., American Smelting & Refining Co. 27
120 Broadway, New York 5, N. Y.

Formax Mfg. Corp. 132
3171 Bellevue, Detroit 7, Mich.

Frank, Paul 138
118 E. 28th St., New York 16, N. Y.

G. S. Equipment Co. 57
15585 Brookpark Rd., Cleveland 35, Ohio

Gumm Chemical Co., Inc., Frederick 8
538-542 Forest St., Kearny, N. J.

Hamilton Emery & Corundum Co. 140
Chester, Mass.

Hanson-Van Winkle-Munning Co. 6, 7, 62, 107
Matawan, N. J.

Hardwood Line Mfg. Co. 138
2022 N. California Ave., Chicago 47, Ill.

Harshaw Chemical Co., The 14, 15
1945 E. 97th St., Cleveland 6, Ohio

Heil Process Equipment Corp. 35
12914 Elmwood Ave., Cleveland 11, Ohio

Holland & Sons, Inc., J. 60
475 Keap St., Brooklyn 11, N. Y.

Hooker Chemical Corp. 37
1306 Union St., Niagara Falls, N. Y.

Hull & Co., Inc., R. O. 61
1302 Parsons Ct., Rocky River 16, Ohio

Ideal Chemical Co. 144
1499 Dean Dr., So. Euclid 21, Ohio

Industrial Filter & Pump Mfg. Co. 41
5906 Ogden Ave., Cicero 50, Ill.

Industrial Instruments, Inc. 139
89 Commerce Rd., Cedar Grove, N. J.

Jelco Finishing Equipment Corp. 54
153 E. 26th St., New York 10, N. Y.

Kelite Corp. 124
81 Industrial Rd., Berkeley Heights, N. J.

Koch Sons, Inc., George 134
10 S. 11th Ave., Evansville 4, Ind.

Kosmos Electro-Finishing Research, Inc. 48
140 Liberty St., Hackensack, N. J.

Kushner, Dr. Joseph B. 140
621 S. Norman, Evansville 14, Ind.

Lasalco, Inc. 5
2820-38 LaSalle St., St. Louis 4, Mo.

Lea Mfg. Co. 99, 100
16 Cherry Ave., Waterbury 20, Conn.

Lea Products Co. 56
996 De Boullion St., Montreal 15, Quebec, Can.

Lea-Ronal, Inc. 101, 102
130-19 180th St., Jamaica 34, N. Y.

Lindale Equipment & Supply Corp. 142
504 Smith St., Brooklyn 31, N. Y.

MacDermid, Inc. ..... 64, Back Cover
Waterbury 20, Conn.

Manhattan Rubber Div., Raybestos-Manhattan, Inc. 56
6 Willett St., Passaic, N. J.

Meaker Co., The 49
Sub. of Sel-Rex Corp., Nutley 10, N. J.

Metal & Thermit Corp. 19-22
Rahway, N. J.

Michigan Buff Co., Inc. 143
3503 Gaylord Ave., Detroit 12, Mich.

Mitchell-Bradford Chemical Co. 34
Wampus Lane, Milford, Conn.

Motor Repair & Mfg. Co., The 144
1555 Hamilton Ave., Cleveland 14, Ohio

Munning & Munning, Inc. 112
202-208 Emmett St., Newark 5, N. J.

Murray-Way Corp. 131
P. O. Box 180, Maple Rd. E., Birmingham, Mich.

National Plastics & Plating Supply Co. 50
Box 34, Terryville, Conn.

N. J. Thermex Co., Inc. 129
535 Bergen St., Harrison, N. J.

Northwest Chemical Co. 18
9310 Roselawn Ave., Detroit 4, Mich.

Nuodex Products Co. 44, 45
Box 242, Elizabeth, N. J.

Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.

Packer Machine Co. 114
456 Center St., Meriden, Conn.

Park Equipment & Supply Corp. 144
604 - 20th St., Brooklyn 18, N. Y.

Pesco Plating Equipment Corp. 143
75 Wythe Ave., Brooklyn 11, N. Y.

Pfizer & Co., Inc., Chas. 55
630 Flushing Ave., Brooklyn 6, N. Y.

Phelps Dodge Refining Corp. 118
300 Park Ave., New York 22, N. Y.

Phillips Manufacturing Co. 109
3475 W. Touhy Ave., Chicago 45, Ill.

Pittsburgh Plate Glass Co., Chemical Div. 42, 43
One Gateway Center, Pittsburgh 22, Pa.

Plating Products, Inc. 130
1509 N. Washington, Kokomo, Ind.

Plating Service & Equipment Corp. 142
1401 Conner, Detroit 15, Mich.

Ramco Equipment Corp., Div. Randall Mfg. Co., Inc. 141
801 Edgewater Rd., New York 59, N. Y.

Rapid Electric Co. ..... Inside Front Cover
2881 Middletown Rd., Bronx 61, N. Y.

Raybestos-Manhattan, Inc. Manhattan Rubber Div. 56
Passaic, N. J.

Reading Industrial Equipment Co., Inc. 145
P. O. Box 765, Reading, Pa.

Reliable Industrial Equipment Co. 144
633 Richmond St., Grand Rapids 4, Mich.

Rona Pearl Corp., Div. Rona Laboratories, Inc. 136
E. 21st & E. 22nd Sts., Bayonne 3, N. J.

Schaffner Mfg. Co., Inc. 52
Schaffner Center, Emsworth, Pittsburgh 2, Pa.

Seaway Nickel Corp. 48
101 East Ave., No. Tonawanda, N. Y.

Sel-Rex Corp. ..... Inside Back Cover
75 River Rd., Nutley 10, N. J.

Sethco Mfg. Corp. 25
2286 Babylon Turnpike, Merrick, L. I., N. Y.

Singleton Co., The 28
11720 Berea Rd., Cleveland 11, Ohio

Sommers Bros. Mfg. Co. 140
3439 No. Broadway, St. Louis 7, Mo.

Stevens, Inc., Frederic B. 16, 17
1808 - 18th St., Detroit 16, Mich.

Stutz Co., The 40
4430 W. Carroll Ave., Chicago 24, Ill.

Technic, Inc. 63
88 Spectacle St., Cranston, R. I.

True Brite Chemical Products Co. 132
P. O. Box 31, Oakville, Conn.

Turco Products, Inc. 111
24600 So. Main, Wilmington, Calif.

Twin City Testing Corp. 58, 59
P. O. Box 95, Tonawanda, N. Y.

Udylite Corp., The 113, 115, 117, 119
Detroit 11, Mich.

Unit Process Assemblies, Inc. 46
53-15 37th Ave., Woodside 77, N. Y.

Universal Vibrating Screen Co. 52
1745 Deane Blvd., Racine, Wis.

Virginia-Carolina Chemical Corp. 24
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Worthy Products Co. 144
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Wyandotte Chemicals Corp. 31
Wyandotte, Mich.

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